April 1979 $2.50

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W2NSD/1
NEVER SAY DIE
editorial by Wayne Green

WHICH PAGE DO YOU READ?

On page 6 of the March issue of *Ham Radio Horizons* (also reprinted in *HR*), an editorial discounted the gloom and doom reports about WARC, saying G&Ders "apparently get their information from the Wizard of Oz—or some other equally unlikely source." On page 11 of the same magazine, a wizard tells us in the lead item of Newsline that broadcast interests are threatening us at WARC. Some schizophrenia there?

There was no specific mention of anyone in the editorial, just a few straw men set up and toppled. Since I've written about WARC recently, I tried to identify any possible references to my writing, but failed. Like the League, I feel optimistic and agree with them that the ITU *can't* kill amateur radio. It is unthinkable and I am not thinking it. I do regret that something positive wasn't done just to make sure, particularly in the face of the massive losses amateur radio has suffered in recent years—and I consider the loss of 239,000 MHz of satellite microwave ham allocations a massive loss. *Ham Radio Horizons* knows all about this loss and just ignored it.

They also know about the meetings in the next few weeks between the African and Latin American lesser-developed countries (LDCs), which are for the express purpose of shooting down the US position at WARC. These are the countries which may well swing the tide at WARC ... and they are not friends of amateur radio.

But these are things which won't have much of an impact on us, even if the worst happens, for many years, so why get all exercised over something over which we no longer have much control? For the next few years, we are going to be in the middle of a sunspot maximum ... DX will be good ... the VHFs will be hopping ... and we will have more exciting new modes coming along than most of us can handle.

If amateur radio really gets clobbered at WARC, perhaps we can use the years before our country agrees to the new allocations to do some of the lobbying for amateur radio in the LDCs that we should have done in the last year ... and perhaps turn things around. We sure need a worldwide lobbying effort to bring the value of amateur radio to smaller countries out in the open. I'm optimistic.

1979 HAM INDUSTRY CONFERENCE

With our fourth annual ham industry conference in Aspen, new records were set. For instance, I think that this was the fourth year in a row that our confirmed reservations on either Rocky Mountain or Aspen Airlines were met with a slight smile and a shrug of the shoulders when we came to their departure desk at Denver.

Hertz and Avis were up to the situation ... no cars available for us to drive to Aspen. National really was geared for this ... they had one car available, but with a $250 charge if we dropped it at Aspen ... take it or leave it. We grumbled a whole lot, but we took it.

The four of us, Sherry Smythe, Chuck Martin WA1KPS of Tufts Electronics, Eric Williams WA1HON, and I drove over the mountains some 200 miles to Aspen. The road was icy most of the way, but we still made good time, after what is becoming a ritual dinner at Holly West in Denver before our annual drive to Aspen. Chuck played bluegrass on his guitar through much of the trip and we all sang as we went over the mountain passes.

The snow in Aspen was superb, as usual.

On the first evening, we had our worst meal of the week ... a cheese fondue at Guido's Swiss Inn. Ugh. It sort of discouraged much of the shop talk that usually accompanies our meals in Aspen. But the next night we did much better at the Copper Kettle. It was there that we had our first coincidence.

I had just finished handing out some brochures from an advertising agency in New York which was pitching ham businesses to use a ham-run agency. We were all sitting around reading the brochures when the

Continued on page 152

Am I having a good time? With a 73" base of packed powder and almost nightly snow flurries of light powder, you know I am. If only New Hampshire skiing was like this more of the time!

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CES '79

CES: three letters with a lot of meaning to the American economy. These letters stand for the Consumer Electronics Show, a twice-yearly gathering of all those who manufacture and sell the myriad of electronic and electronic-related products which wind up in your home and mine. During the summer, the city of Chicago plays host to this gathering, but come January, it's Las Vegas where the action is.

Residing in southern California has certain advantages. Other than writing for this magazine, I earn my keep from consumer electronics, and a show like this is one I do not want to miss. Las Vegas being but a 45-minute flight or five-hour drive, I try to be in attendance when such events take place. Mother Nature being kind and keeping I-15 open made the decision to drive an easy one. Armed with my 35mm camera, extra film and batteries, a Clegg FM-27B, and a Midland 13-509, I aimed the nose of my Ford Maverick northeast along California Highway 14. Destination: the Hilton Convention Center in Las Vegas.

Two pieces of advice to anyone planning to attend a trade show such as this. First, get a good night's sleep before going. Second, buy the most comfortable pair of shoes your budget will allow. Also, if like me you intend to photograph things, get the lightest camera and strobe you can find.

The CES is the place where everyone who is anyone shows everything. There are televisions, radios of every description, VCRs, home computers, and even amateur radio gear. That's right, amateur radio. Ham gear seems to be playing a more and more significant role in this show each year. In the past, it had been CB which had cornered the personal communications aspect of CES, with amateur radio ranking a distant last. This year, however, perhaps due to the teetering condition of the CB industry in relation to its past performance, amateur radio and related products were right up there with the rest. Wilson had their entire amateur product line on display, as did a number of others such as Pace, Lunar Electronics, and Sujitsu-Ten. In the peripheral department, there were such standbys as Antenna Specialists, Hy-Gain, Hustler, and a new entry to the amateur market well known to CB enthusiasts: Avanti. In fact, Avanti has come into the amateur market with a most-advanced line of fixed station and mobile antennas, including a gain antenna for two meter mobile operation which requires no holes in the vehicle and no external wiring. You simply glue it to the window and plug it into your radio. They have a similar one for 10 meter enthusiasts, as well as a diversity beam which permits you to adjust polarization from your shack. All in all, a very interesting arrival in the amateur marketplace.

You could easily tell the hams at the show. There was no need to look for badges—very few were visible. The hams were the ones playing with radios like the new NDI or Pace or Midland entries. They were to be found examining handhelds and antennas at the various booths. No one knows how many of the 66,000 attendees were amateurs, but there sure were a lot of them and they were not hard to spot.

Hustler, Midland, Pace, and the rest. These are all names familiar to those of us who are involved in the amateur radio game. I'll tell you one thing, though. It was nice to see them giving the amateur service the kind of exposure it needs in a place where so many could see it. CES was great. Amateur radio's representation was about 1%, I guess, but that was good. Better than ever!

THE WHATEVER HAPPENED TO HIM DEPARTMENT

Richard B. Cooper. Now, that name should ring a bell with you. No? How soon we forget. Last year a man calling himself Richard B. Cooper and professing to be an attorney startled the amateur community with such announcements as a lawsuit against the ARRL and his intentions to "grab" at least half of the current amateur spectrum for expanded CB. "Rick," as he called himself, was really making a name for himself. Then suddenly he just vanished from sight! It became impossible to contact either Cooper or the "law firm" he claimed to own: the Communications Attorney Service. Where has he gone? Your guess is as good as mine. What has happened to him over the last year or so is really what is of interest.

It seems that amateurs were not the only ones interested in Rick Cooper and his Communications Attorney Service. Rick was making a lot of claims back then as to the power and scope of his organization, its goals, and its membership. Eventually the matter drew the attention of the Office of the Attorney General of the State of California. An investigation by the Attorney General's office led to a formal civil complaint against Cooper, CAS, and Does 1 through 20, inclusive. The complaint, case #0233123, was filed in March of 1978 in the

Bill Cody demonstrated the new Pace 2 meter rig at the CES.

Mr. and Mrs. Lou Anxiaux of Lunar Electronics. Lou (WB6NMT) was author of the VUAC's 2 meter band plan.

Novice, QRP, 200 w, deluxe — good, better, best — $299, $369, $399, $699, $869, $899, $1069. TEN-TEC has them all. A choice of seven HF transceiver models — a choice of power levels — a choice of operating features (and accessories) for beginner or old timer. Best of all, there's a wide choice of prices to fit every amateur budget.

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The choice is all yours when you choose TEN-TEC HF transceivers; see your nearest dealer or write for full details.

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WIDEST CHOICE IN HF TRANSCEIVERS: TEN-TEC

John Clark (right) of the ARRL displayed League publications at CES '79.

Superior Court of the State of California for the County of Los Angeles. It asked that the court issue an injunction against Cooper and his CAS on five specific violations of both the civil and business/professions code of the state of California, and further requested that the court exact monetary penalties on each count of each violation.

Cooper was served the necessary documentation and at that point dropped out of sight. Nothing has been heard from him since. According to Assistant State Attorney General Herschel T. Elkins, who has been handling the Cooper/CAS matter, Cooper lost the case by default. Shortly, a hearing will be held to set the penalties in this case. Collecting them may be another matter. Cooper, as elusive as a fox, has disappeared without a trace. If you happen to know of Rick's whereabouts, you might drop a note to Mr. Elkins or to me. A lot of us would like to know what ever happened to Rick Cooper.

220—A LATE-BREAKING DEVELOPMENT

The 220-MHz Spectrum Management Association of Southern California (220-SMA) has filed a formal petition for reconsideration on FCC docket 20271, the document recently issued by the Commission relative to US WARC preparations in which maritime is made the prime user of the spectrum between 216 and 225 MHz.

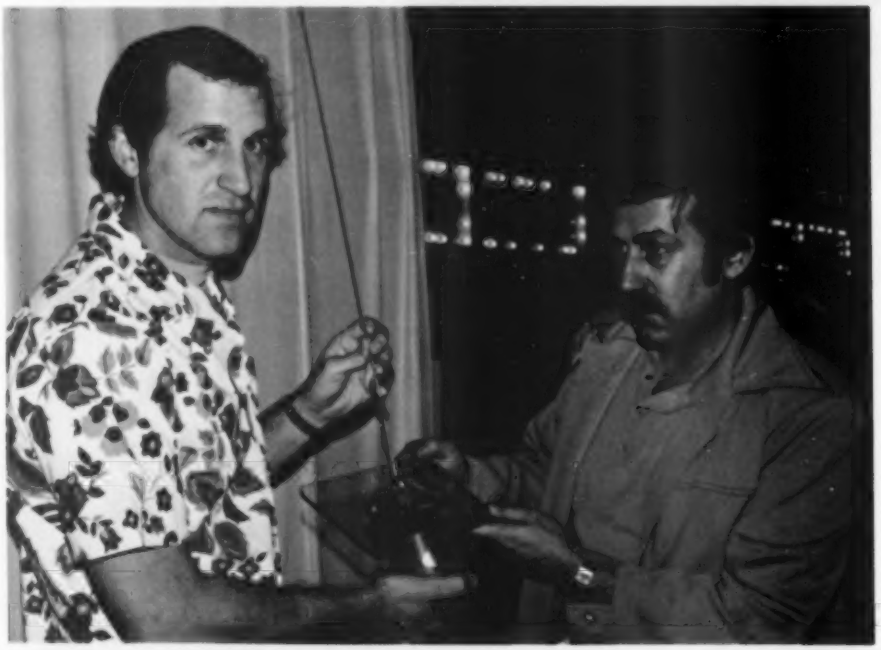
In its appeal, 220-SMA states its belief that representatives of the amateur service have not been given their chance under the structure of administrative procedures to properly comment on the proposed sharing with the maritime mobile radio service. 220-SMA goes on record as opposing the suggested reallocation and suggesting an allocation within the 890-MHz spectrum be considered as an alternative, in that such spectrum would be available worldwide since it has little or no utilization at this time. Implementation of a maritime mobile service in that spectrum would not displace any established activity and would have little environmental impact throughout the entire world.

The petition was prepared by 220-SMA advisor Henry R. Von Neumann K6PUW at the direction of 220-SMA President Larry Mohler WA6DOD, and was derived from input obtained at a joint meeting of 220-SMA, 2mASMA, ARRL Director Holladay, and other VHF spectrum users. VRAC's local representative and the Southern California Repeater Remote-Base Association both declined to attend or take part in the initial planning on this matter, but did ask to be kept informed as matters progressed. However, 2mASMA, along with other local special-interest groups, is expected to endorse the petition, and 220-SMA is requesting that letters of support from coordinators, coordination councils, and individual amateurs be sent to the Commission as soon as possible. Those writing on the subject should refer to 220-SMA petition number 790120, submitted January 22, 1979. It's felt that enough support from the general amateur community might well force the Commission to give this petition serious consideration and perhaps reopen commentary on the matter.

CAN AND WILL THE ARRL SAVE 220?

"220 CB is dead and the ARRL slew it." With that statement, the League tried to take full credit for saving 220 MHz from the onslaught of "10-4 Good Buddy" and the evils that "10-4" would bring with him. They gave only the most abbreviated passing credit to the people who really counted, and never came near to telling the real story of what killed the 220 CB idea. I've heard quite another story. The big rumor is that formal objections from our neighbors north and south are what killed it, not the ARRL. If true, it makes a lot more sense, and I tend to believe it. Let's look at the present situation and the ARRL's power in relation to it.

First, we must assume that there were other forces which really devastated the 220 Class E CB idea. Class E was being pushed by but one entity, the EIA. For the EIA, this was a good move from an economic standpoint. It's a fact that it costs less to manufacture a radio for a lower frequency than for a higher one. This holds true even with today's advanced linear IC technology and mass production. So, if you were running an organization which represented the vast majority of those manufacturing two-way radio equipment, what would you do? You would look around at all spectrum and forge a viable attack to gain some more. When studies of available spectrum were made some years back, the 220-MHz



An Avanti rep explained the new no-holes 2 meter antenna to Bill Orenstein KH6IAF (right).

Continued on page 28

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***ALL* OVERLOADS HANDLED;** dynamic range typically exceeds 90 dB and PIN diode switched 18 dB attenuator also included for extra overload protection.

***ALL* LINEAR/ANTENNA BANDSWITCHING FROM FRONT PANEL;** auxiliary bandswitch terminals on back panel for external relays or circuits are controlled simultaneously by the OMNI bandswitch.

***ALL* INTERFACE JACKS FOR PHONE PATCH;** access to speaker and microphone signals.

***ALL*-LEVEL ADJUSTABLE ALC;** set output from low power to full, retain low distortion at desired drive to power amp.

***ALL* SIDETONE ADJUSTMENTS;** pitch and volume.

***ALL*-POWERFUL, *ALL*-WARRANTED FINAL AMPLIFIER.** 200 watts input to final. Proven design with full warranty for first year and pro-rata warranty for additional 5 years.

***ALL* 100% DUTY CYCLE.** For RTTY, SSTV or sustained hard usage.

***ALL*-MODE POWER:** basic 12 VDC for easy mobile use, external supplies for 117/220 VAC operation.

***ALL* FRONT PANEL MICROPHONE AND PHONE JACKS.** Convenient.

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AND *ALL* THE OPTIONS: Model 645 Keyer, Model 243 Remote VFO, Model 248 Noise Blanker, Model 252MO AC Power Supply.

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LETTERS

MACARONI

After reading "Diodes of the Dead" (*73*, Jan., 1979), I have diagnosed Mr. Dunn's problem. By using high-quality audio tape (Ampex "Grand Master" or Maxell UD35-90), I had absolutely no problem "calling up" two dead aunts and some guy calling himself "Macaroni." Also, I found by using a slightly larger antenna (10'-12'), Alpha Centauri comes in "Q5". 73.

Jerry Robinson III N4KJ
Asheville NC

BRUTAL

With only one element remaining to complete my Extra class ticket, I just had the misfortune to "close encounter" the brand new exam.

My advice: If you're not a mathematician, you'd better take a crash course before you attempt the test. It is a *brutal* mother.

This new Extra class series (dated 9/78) features a central core of 20-or-so questions, each one attached to a schematic. You'll be asked to compute complex reactances, impedances, resonant frequencies, or missing component values at some arbitrary point in the circuit. No formulas are provided, and most of the values you'll be asked to compute *do not* relate easily to any of the material in any of the existing study guides.

The non-mathematical questions, by the way, are extremely esoteric and obscure. There is material on IC junctions, remote base regulations, 5 or 6 questions on SSTV and ATV, and other trivia from the fine print of the regs.

My hunch is that the FCC found itself rapidly running out of 1 x 2 callsigns and decided to plug the small conduit that lets new Extras through. They plugged it good and tight! Be warned. The test is not impossible—but you *will* need lots of math, and *we all* will need new, *competent* study guides—like pronto.

Incidentally, the exam itself is atrociously edited—with numerous typographical mistakes, misspelled words, and my copy even had the wrong element class printed on the cover! The word "ADVANCED" had been pasted over with a sticker that said "EXTRA." My confidence in Uncle's competence was not enhanced.

By the way, fellas and gals, if you haven't yet listened in on the "secret" pseudo-ham band that runs from 27.5 to 28 MHz (above CB and below 10 CW), you're missing some of the funniest (or most infuriating) SWLing of your life!

A recent spot check produced these gems:

1. A spiritualist in Houston who gives psychic readings and conducts on-the-air meditation classes every Sunday.

2. A cross-country SSB QSO between two chaps, one running a TS-820, the other a Yaesu FT-101, shooting the breeze about how they're progressing toward their NOVICE tickets!

3. Someone conducting very graphic, on-the-air sexual counseling via radio.

4. A slow-scan TV signal!

5. Many, many individuals who indicated that they also hold amateur licenses and operate (legally) on other bands.

This latter finding is the most surprising of all. Maybe it's the anarchist spirit having a go—or simple boredom with the routine and formality of the "disciplined" amateur bands. It's certainly true that 11 is a hotbed of radical and innovative radio doings—the likes of which you're not likely to hear anywhere else.

A man in Italy "skeds" his relatives in New York City each morning.

A woman in South Dakota has regular radio pen-pals from Europe to Australia.

You'll even hear high-speed CW QSOs on this crazy band—complete with "Whiskey Club" numbers for ID! It's beyond me why an op who can handle 20 wpm takes his business down there. But turn up your ears and check it out for yourself. There they are.

I will say one thing about the foreign stations who are using "secret band" to sked relatives in this country. I try to imagine these relatively easy, hassle-free contacts taking place in the licensed amateur service, where the DX station would *immediately* be pounced upon by the prick-eared wolf pack, and all hopes of a relaxed rag chew would vanish. I do begin to understand what may be driving even licensed hams to this virgin frontier!

Could it be a radio revolution in the making? Or the prelude to a determined FCC crackdown? Only time will tell. In the meantime, something is definitely happening at one of our borders. It behooves us to listen and evaluate the phenomenon.

Name and address withheld by request

VOYAGING

The JPL Amateur Radio Club, through its club station W6VIO (*Voyager in Outerspace*), will repeat its performance during the *Viking* landings on the planet Mars by holding commemorative contacts during the forthcoming (actually, now in progress) *Voyager* mission to the planet Jupiter.

The spacecraft *Voyagers I* and *II* are currently engaged in the first observational phases of their mission of exploration of the planets Jupiter and Saturn.

Among the data being returned will be pictures of the disc of Jupiter at various distances showing details of the planet that it is not possible to see with any terrestrial telescope of known configuration.

On slow-scan TV, these and other pictures will be sent out for amateurs to see throughout the world.

According to Dick Piety K6SVP, the project coordinator, the first contacts will have been made March 1 through March 11, 1979. This coincides with the encounter phase of the first of the *Voyagers* to arrive near Jupiter. A second encounter period for *Voyager II* will bring on more amateur contacts July 6-15.

The following frequencies will be used plus or minus QRM: CW—30 kHz above bottom edge of the bands, 80 through 10 meters. SSTV—3545, 7220, 14325, 21340, 28680. Novice—3730, 7130, 21130, 28130. SSB—3930, 7230, 14285, 21360, 28680. OSCAR—2 meters and 220-MHz transmissions are planned as well.

As presently set up, the plans call for heavier operations on weekends and between the hours of 4:00 pm and 7:00 pm PST (0000 to 0300 Zulu).

The JPL Amateur Radio Club regrets that it does not have a special commemorative call such as the N6V used during the *Viking* mission. However, W6VIO will issue a special QSL card for the *Voyager* commemorative. An SASE is requested from U.S. stations. DX stations may QSL via their QSL bureaus.

Norman L. Chalfin K6PGX
Pasadena CA

VITRIOL

It would almost be worth buying occasional copies of *73* to see if this letter changes an approach—and if it gets printed under "Letters"—but the odds are against it. Recently there was a debate at the UN between representatives of Vietnam and Cambodia. A TV commentary stressed that although each side called the other liars, it was on a higher, diplomatic, and less corrosive level than a previous controversy when Khrushchev took off a shoe and pounded the table with it. What has this to do with *73*?

Many years ago, almost when you first started *73*, I regularly purchased copies and think even subscribed for a year or so. However, the vitriol dripping from your pen so turned me off that I stopped reading it. Recently, a ham whom I regularly work touted *73*, so I bought two copies.

Even granting that the ARRL could do a better job for ham radio, that it tends to pigeonhole ideas of others, that it is biased against women, and that it is dictatorial in many ways, is it possible that a more affable indictment in publishing their shortcomings would present your ideas in a more acceptable way to your readership and (if a miracle occurred) to the ARRL?

So what do I like about *73*? The December issue had "Close Encounters," which supplied completely new knowledge of use of lasers in a study of UFO phenomena, "From CW to Computers," an interesting presentation of a technique previously known, "DX," a well-concocted column, "Receiver Diseases," some simple ideas in easily readable fashion, "The Packet Radio Revolution," again an informative article. In the January issue, "Time-Domain Reflectometry" answered my ignorance on how public utilities pinpoint problems, and, if I had a scope, a good test technique.

Although doing some necessary home brewing in 1923 (call 2AST) and some since, I am primarily an appliance operator. Making a PC board, etc., frightens me off, but I am able to make repairs to my two transceivers which are solid state. My interest is CW at 25 wpm up, except for one or two schedules per week on SSB with old-timers who have large-

Continued on page 46

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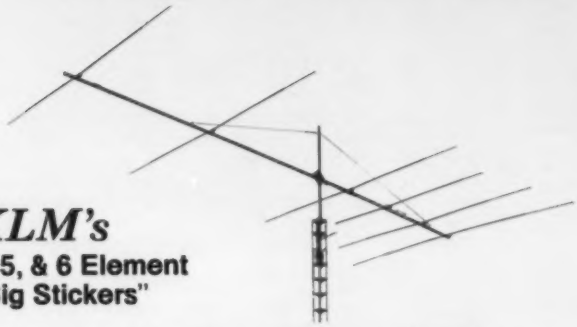

KLM's
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For DX on 80, 40, 20, 15 & 10 meters, more and more contesters are taking advantage of the "Big Stickers'" unbeatable gain, bandwidth, and pattern.

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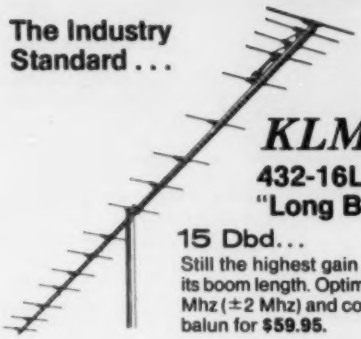

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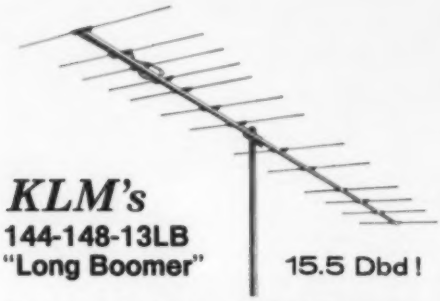
15 Dbd...

Still the highest gain antenna for its boom length. Optimized for 432 Mhz (±2 Mhz) and complete with balun for **$59.95.**



KLM's
144-148-13LB "Long Boomer"

15.5 Dbd!

Our latest entry into super-gain VHF antennas, the 13 element "Long Boomer" has more honest KLM gain than our famous 2M-16. Balun included for **$69.95.**

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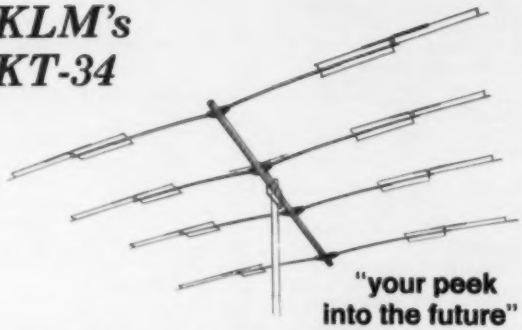

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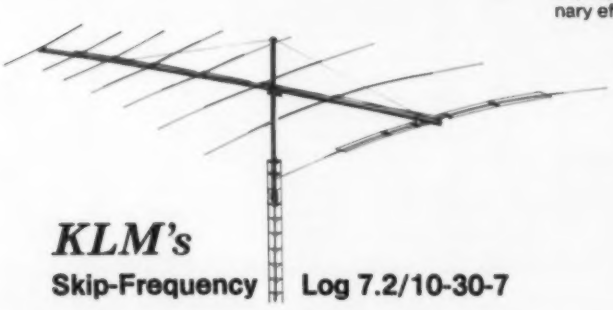

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arma amateur radio manufacturer's association

Contests

Robert Baker WB2GFE
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ANNUAL APRIL QRP QSO PARTY

Starts: 1600 GMT
Saturday, April 7
Ends: 2400 GMT
Sunday, April 8

The contest is open to all amateurs and is sponsored by the QRP Amateur Radio Club International, Inc.

Stations may be worked once per band for QSO and multiplier credits. Each member QSO counts 3 points, non-member QSOs, 2 points. Stations other than W/VE count as 4 points per QSO. Multipliers are as follows: more than 100 Watts input power—x1; 25 to 100 Watts—x1.5; 5 to 25 Watts—x2.0; 1 to 5 Watts—x3.0; less than 1 Watt power—x5.0.

Final score is QSO points times total number of states/provinces/countries *per band* times power multiplier.

EXCHANGE:

Members—RS(T), state/province/country, QRP number.

Non-members—RS(T), state/province/country, power input.

FREQUENCIES:

CW—1810, 3560, 7060, 14060, 21060, 28060, 50360.

SSB—1810, 3985, 7285, 14285, 21385, 28885, 50385.

Novice—3710, 7110, 21110, 28110.

All frequencies ±5 kHz.

ENTRIES:

Send full log data, including full name, address, and bands used. Indicate equipment, antennas, and power used. Include a #10 SASE for results. Logs must be received by April 30, 1979, to qualify. Send logs to: E. V. Sandy Blaize W5TVW, 417 Ridgewood Drive, Metairie LA 70001.

Certificates will be awarded to the highest scoring station in each state/province/country, and other places depending on activity. One certificate for the station showing three "skip" contacts using the lowest power.

BERMUDA AMATEUR RADIO CONTEST

Starts: 0001 GMT April 21
Ends: 2400 GMT April 22

Sponsored by the Radio Society of Bermuda. Operate no more than 36 hours of the 48-hour contest period. Off periods to be clearly logged and each period to be of not less than 3 consecutive hours.

All stations shall be single operator only and must be operated from their own private residence or property. Each station may be worked only once per band regardless of mode. Use all bands 80 to 10 meters, but no crossband or crossmode contacts permitted.

EXCHANGES:

All stations exchange RS(T) and following: UK—county, US—state, VE—province, Bermuda—parish, West Germany—DOK #.

US and VE stations must exchange reports with UK, West German, and Bermuda stations only. UK and West German stations must exchange reports with US, VE, and Bermuda only.

SCORING:

Calendar

Apr 7-8	ARRL Open CD Party—CW
	QRP QSO Party
	SP DX Contest—CW
Apr 11-12	DX YL to NA YL Contest—CW
Apr 14-15	SP DX Contest—Phone
Apr 18-19	DX YL to NA YL Contest—Phone
Apr 21-22	County Hunters SSB Contest
	Bermuda Contest
	ARRL EME Contest (Part 1)
	ARRL Open CD Party—Phone
Apr 28-29	PACC DX Contest
	Zero District QSO Party
	Helvetia 26 Contest
	YL ISSB QSO Party—Phone
May 5-6	NY State QSO Party
May 12	World Telecommunications Day Contest—Phone
May 12-13	Luckenbach DXpedition
May 19	World Telecommunications Day Contest—CW
May 19-20	ARRL EME Contest (Part 2)
	Michigan QSO Party
	Mass QSO Party
May 26-27	CQ Worldwide WPX—CW
June 9	DAFG Short Contest—SW
June 9-10	ARRL VHF QSO Party
June 10	DAFG Short Contest—VHF
June 23-24	ARRL Field Day
June 30-July 1	Seven-Land QSO Party
July 4	ARRL Straight Key Night
July 14-15	ARRL IARU Radiosport Competition
Aug 4-5	ARRL UHF Contest
Sept 8	DAFG Short Contest—VHF
Sept 8-9	ARRL VHF QSO Party
Sept 9	DAFG Short Contest—SW
Sept 15-16	Scandinavian Activity—CW
Sept 22-23	Scandinavian Activity—Phone

Results

CANDLEWOOD AMATEUR RADIO ASSOCIATION
1978 CONNECTICUT QSO PARTY RESULTS

W1QI, the CARA club station, was operated by Steve WB1CVU, Skip W1PV, Dan W1QK, Louis WA1GSO, George WB2THN/1, and George WB1DIP. The group made 355 QSOs with 50 multipliers for a total score of 17750 points. They also worked all eight counties in Connecticut.

CONNECTICUT SCORES

County	*Station*	*Pts.*	*Mult.*	*Score*	*Ctys.*
Fairfield	WA1FCN*	387	63	24381	8
Hartford	WA1SQB**	561	71	39831	8
Litchfield	W1VH*	171	40	6840	8
Middlesex	W1JTD*	98	30	2940	8
New Haven	WA1UUA*	477	64	30528	8
Tolland	WB1EKI*	29	12	338	6
Windham	K1YRP*	165	34	5610	8
	Novice				
Hartford	WB1CRH/N*	20	11	220	0

OUT-OF-STATE SCORES

Section	*Station*	*Pts.*	*Ctys.*	*Score*
Arizona	WB7CPY*	14	3	42
E. Mass.	WA1LZS*	62	8	496
E. New York	WA2OTC**	94	8	752
E. Pennsylvania	N3AI*	81	8	648
Georgia	K4JSG*	90	8	720
Illinois	WA9FET*	46	8	368
Iowa	WB0TLE*	56	8	448
Kentucky	WA4OMH*	6	4	24
Louisiana	W5WG*	89	8	712
Maine	WA1ZAX*	42	8	336
Maryland	W3PYZ*	55	8	440
Michigan	W8WVU*	56	8	448
Mississippi	AF5V*	18	5	90
Nevada	AE7K	1	1	1
New Hampshire	K1ITS*	69	8	552
New Mexico	W5UBW*	15	4	60
New York, LI	W2RPZ*	46	8	368
North Carolina	WA4GLE*	22	5	110
North Dakota	WD0CCL*	16	5	80
N. Florida	W9WZV/4*	11	4	44
N. New Jersey	K2HLC*	52	8	416
N. Texas	N5UM*	51	8	408
Ohio	WB8YDN*	57	8	456
San. Bar.	W6OUL*	15	5	75
S. Dakota	W0CLS*	47	8	376
S. Florida	AA4MI*	42	7	294
S. New Jersey	W2UAP*	43	8	344
S. Texas	WA5OOB*	69	8	552
Virginia	N5BAJ/4*	37	8	296
Washington	WB7UXK*	25	7	175
W. New York	N2RT*	39	8	312
W. Pennsylvania	K3LVO*	14	5	70
Wisconsin	WB9PVI*	58	8	464
	Canada			
Ontario	VE3KK*	53	8	424
	DX			
Japan	JE2MDE	1	1	1

*County or section winner
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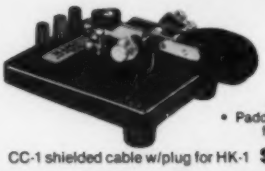
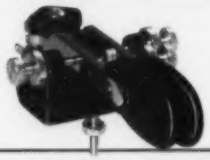


Model HK-1

- Dual-lever squeeze paddle
- Use with HK-5A or any electronic keyer
- Heavy base with non-slip rubber feet
- Paddles reversible for wide- or close-finger spacing

$29.95

CC-1 shielded cable w/plug for HK-1 **$4.49**



Model HK-2

- Same as HK-1, less base for incorporation in own keyer

$19.95

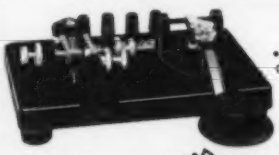
Model HK-3

- Deluxe straight key
- Heavy base...no need to attach to desk
- With navy type knob

$16.95

Model HK-3A
- Same as above less base **$9.95**

CC-3 shielded cable w/plug for HK-3 **$3.95**



Model HK-4

- Combination of HK-1 and HK-3 on same base

$44.95

CC-1/3 shielded cable w/plugs for HK-4 **$7.95**

Model HK-5A
Electronic Keyer

- New Cabinet Colored-Keyed to Match most modern radio equipment
- Iambic Circuit for squeeze keying
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Each QSO = 5 points. Multiplier for all stations outside Bermuda is the total number of VP9s worked on each band. The same VP9 can be worked on all bands. For Bermuda stations, it is the total number of states, provinces, counties, and DOK #s worked on each band.

AWARDS:

Top scorer in each state, province, county, and DOK area in West Germany shall receive a certificate. Trophy to top scorer in VE, US, UK, and West Germany. Round-trip air transportation plus accommodation will be provided to overseas winners to enable them to receive their awards.

ENTRIES:

All dates and times in GMT. All contestants to check for duplicates and to compute their own scores. Sign a statement that all rules and regulations have been observed. Each page must be clearly marked with call, name, and address, and must be received by the contest committee before June 30. Send entries to: PO Box 275, Hamilton 5, Bermuda.

Note: Please submit a log if you operate in the contest. This

Continued on page 28

Results

1978 DELAWARE QSO PARTY RESULTS

OUT-OF-STATE SCORES

*Denotes state winner
**Denotes high score for out-of-Delaware station

State	*Station*	*Score*	*QSOs*
Alabama	W4PVK*	400	33
Alaska	KL7IXZ*	60	4
Arizona	K9HRC/7*	330	11
California	N6PE*	1485	27
Colorado	N9FS*	455	13
Connecticut	W1VH*	700	20
Florida	K4YS*	1450	29
Idaho	WB7URE*	150	10
Illinois	W9QWM*	1550	31
Iowa	WBØUCP*	275	11
Louisiana	WB5UQW*	105	7
Maryland	W3PYZ*	1160	29
Massachusetts	W1JR*	1155	21
Minnesota	NØAJJ*	240	8
Missouri	KØBM*	1860	31
Montana	K7PGL*	175	9
New Hampshire	K1ITS*	2600	40
New Jersey	N2CW**	5000	50
New Mexico	W5UBW	200	8
New York	W2EY*	1035	23
North Carolina	W4OMW*	665	19
Ohio	WD8DKJ*	800	20
Oregon	AD7L*	2240	28
PA	WB3JGP*	420	12
Texas	W5NR*	600	15
South Dakota	KØJV*	630	14
South Carolina	K4BZD*	160	8
Virginia	W4ZRJ*	120	8
Washington	WB7QEL*	120	8
West Virginia	N8AMZ*	60	6
Quebec	VE2EDL*	140	7
Ontario	VE3DAP	3600	44

DELAWARE SCORES

*Denotes county winner
**Denotes high score for Delaware

New Castle	*Score*	*QSOs*
N3ND**	67650	504
K3SM	58081	410
W3HB	44499	339
K3HBP	21900	247
N3AHA	20043	200
W3HK5	1824	57
WB3GOI	702	39
(N3ND was multi-multi with K3SXA)		
All Counties—Mobile		
K3KX/M3	8200	123
(Drove from Pittsburgh, Pa., to be in test)		
Kent	*Score*	*QSOs*
WB3DDS*	27604	408
N3AKC	11193	152
WA3QLS/3	11033	187
Sussex	*Score*	*QSOs*
WB3IXC/3*	52096	456
WB3KYL/3	40442	449
K3JL	22743	203
WA3WIY	2016	43

Results

PUBLICATIONS CONTEST RESULTS

Results of the Amateur Radio News Service 1978 Publications Contest have just been released by judges Norm Monro K4FRY, Vivian Douglas WA2PUU, and Dan Dolan K4RN.

Submissions for this contest were divided by publisher and size into two groups. Group I consisted of club papers: I(a). less than 100 copies; I(b). 100-199 copies; I(c). 200-299 copies; I(d). 300-399 copies; I(e). 400 or more copies. Group II contained multi-club papers: II(a). less than 1000 copies; II(b). 1000 or more copies.

The club presidents of the winning entries will receive certificates to be presented to their groups. All editors will be receiving the judges' comments by personal letter. Congratulations to the following:

Group I:

I(a): First prize: *The Salami Merchant*, Silvercreek Amateur Radio Association, Doylestown OH 44203. Al D'Aurelio W8WKY, Editor.
Second prize: *Hamtrix*, West Allis Amateur Radio Club, Inc., Milwaukee WI 53211. David J. Knaus WA9POV, Editor.
Third prize: *Mid-Sussex Matters*, Mid-Sussex Amateur Radio Society, Burgess Hill, East Sussex, England. Alfred Lee G4DQS, Editor.
I(b): First prize: *QCC News*, Chicago Area Chapter, QCWA. Lee J. Knirko W9MOL, Editor.
Second prize: *66/06 Newslines*, Westchester Emergency Communications Association, North Tarrytown, New York 10591. Mervin Genzer WA2HZD, Editor.
Third prize: *The Call Letter*, Poway Amateur Radio Society, Poway CA 92064. Glen Peterson WB6BOD, Editor.
I(c): First prize: *QUA*, Warrington Area Repeater Association, Warrington PA 18976. Bruce Gilman WB3CFE, Editor.
Second prizes (ties): *The Orbit*, The Satellite Amateur Radio Club, Vandenberg Air Force Base CA 93437. John E. Douglass WA6EZZ, Editor. *FM News*, UK FM Group (London), London, England. Alan D. Gray G8LCO, Editor. *Ham Rag:* Rockford Amateur Radio Association, Rockford IL 61110. Darrell B. Crimmins WD9FVG, Editor.
Third prize: *Red Rose Repeater Association (Newsletter)*, Lancaster PA 17601. Martin Bloomberg WA3MHP, Editor.
I(d): First prize: *Carrier*, Mt. Diablo Amateur Radio Club, Inc., Pleasant Hill CA 94523. Harold S. Mumford W6CU, Editor.
Second prize: *Cheese-Bits*, Mt. Airy VHF Radio Club, Inc., Elkins Park PA 19117. Harry B. Stein W3CL, Editor.
Third prize: *QRZ*, Rocky Mountain Radio League, Golden CO 80401. Jim Labo KØQST, Editor.
I(e): First prize: *Amsat Newsletter*, Radio Amateur Satellite Corporation, Washington DC 20044. Joe Kasser G3ZCZ, Editor.
Second prize: *The Round Table*, The Denver Radio Club, Denver CO 80202. Robert N. Jensen WØWLN, Editor.
Third prize: *The Modulator*, Baltimore Radio Club, Inc., Baltimore MD 21203. Roland Slatkoff W3RUN, Editor.

Group II:

II(a): First prizes (ties): *Mobile News*, Amateur Radio Mobile Society, Purley, England CR2 1EZ. Norman A. S. K. Fitch G3FPK, Editor. *220 Notes*, edited by Julian N. Jablin W9IWI, Skokie IL 60076. Bus. Mgr. is Virginia L. Sterling WB9UFW, Morton Grove IL.
Second prize: *CORA Collector and Emitter*, Central Oklahoma Amateurs, Inc., Oklahoma City OK 75155. Joe K. Harding WA5ZNF, Editor.
II(b): First prize: *Repeater Journal*, Carolinas-Virginia Repeater Association, Durham NC 27705. Wayne Williams K4MOB, Editor.
Second prize: *The Hamateur*, Edited by Larry McCalvy WA9JMO, Milwaukee WI. Honorable Mention: *Radio-Hobbyist Newsletter*, American Radio Council, Garland TX 75040. Frederick W. Maia W5YI, Editor.

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3600A	50Hz - 600MHz	Oven .5 PPM 17° - 37°C	10MV	10MV	50MV	8	.5 Inch	115VAC or 8.2 - 14.5VDC	2¼"H x 8"W x 5"D
3550W	50Hz - 550MHz	1 PPM 65° - 85°F	25MV	25MV	75MV	8	.5 Inch	115VAC or 8.2 - 14.5VDC	2¼"H x 8"W x 5"D

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DX

Chuck Stuart N5KC
5115 Menefee Drive
Dallas TX 75227

DX PROFILE

This month's DX Profile is on Bob Geary 5Z4NH of Thika, Kenya, East Africa. The following is a letter from Bob describing his background and his life in Kenya:

"I first became interested in amateur radio in 1946 when I helped Larry W8VPA carry his BC-610 up the stairs. I have not recovered either my sanity or my back since then. I was first licensed in 1957 as K2ZLE and became interested in VHF as a member of the VHF Institute in New York City. I managed to work a VO1 from Brooklyn without the aid of a repeater, but I didn't realize that it was much of a feat until later.

"I arrived in Kenya in 1965 to take up the job of teaching chemistry in the Kenya schools. The courses here are the same as you would find in an American high school or junior college.

"Due to some very bad misinformation from a 'know-it-all' type who told me that I would not be able to get a license here in Kenya, I was off the air until 1972. Upon learning the true facts, I was readily and graciously issued a license by the Kenya authorities. It is interesting to note that an American can easily obtain operating permission here in Kenya, but that the reverse does not hold true for someone from Kenya trying to obtain operating permission in the US.

Bob Geary 5Z4NH.

"The people of Kenya come from a civilization and culture which is several centuries old. They are very gracious and kind to outsiders. In all my years here in Kenya, I have met only one Kenyan who was not a desirable person. The weather here is more pleasant than that of either Florida or southern California. In the highlands, the temperature ranges from 65° F in the evening up to about 85° F during the day. The rains, which come in two seasons, are heavy at times, but are warm and without strong winds. The sun shines better than nine hours a day during the dry seasons, and it is easy to develop a nice tan in only a short time. The coastal area is a bit warmer, but it is some 5,000 feet lower in altitude.

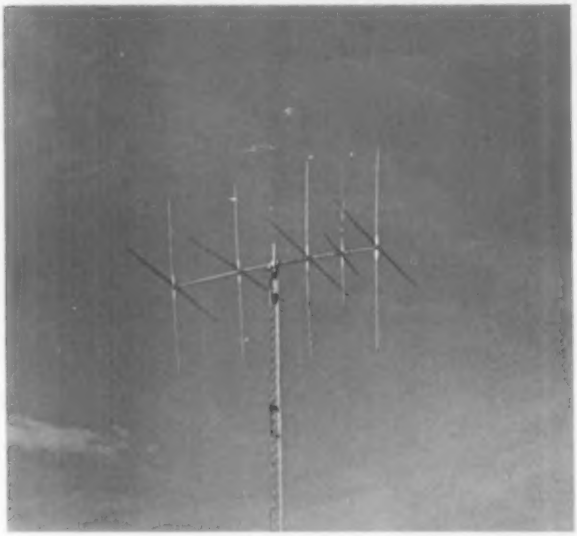
"The numerous recreation opportunities include golfing, boating, mountain climbing, camping, and, of course, the popular photo-safaris. Kenya is not only a great place to visit, but a perfect place to live as well. About the only inconvenience is having to wait until the giraffes pass before I can get to the school building some mornings. Being mute, the giraffe has few outlets for his anger; since they can kill a lion with one kick, I allow them plenty of clearance.

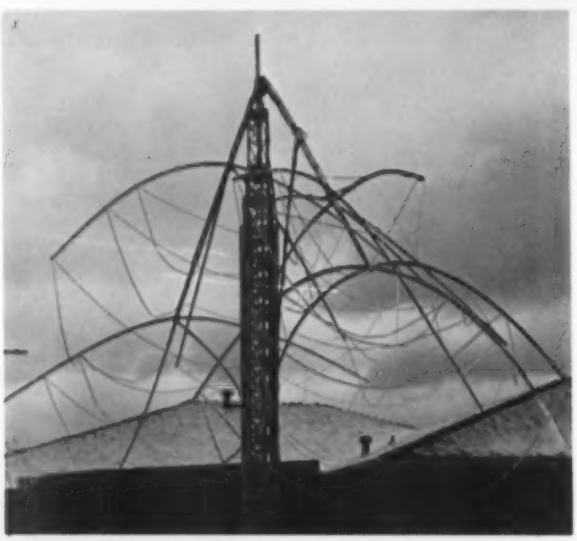
"Being in almost the center of the world's land masses, Kenya is a perfect amateur radio QTH. California, New Zealand, Chile, Japan, Alaska, and Antarctica are all almost equidistant from Nairobi. The elevation of 5,000 to 7,000 feet gives a perfect 360-degree downhill shot to the entire world. The low winds and easy availability of free bamboo make Kenya perfect for quad antennas. I have made better than 13,000 contacts in 250 countries without any special DX effort.

"Kenya 'Field Day' activities are functional, in that we supply communications for the annual East Africa Safari Race. The Radio Society of Kenya sets up a control station in Nairobi and dispatches members to some rather distant locations to set up and operate under horrible conditions. One year I drove 42 miles on a muddy road, set up the rig and contacted the control station, only to be informed that the race had been rerouted due to floods. I then repacked the gear and drove back to Nairobi, checked in, and was dispatched to another location, fortunately on the tarmac, but still wet and rainy. The volunteer stations are the only means of communication between the race organizers and the cars out on the course.

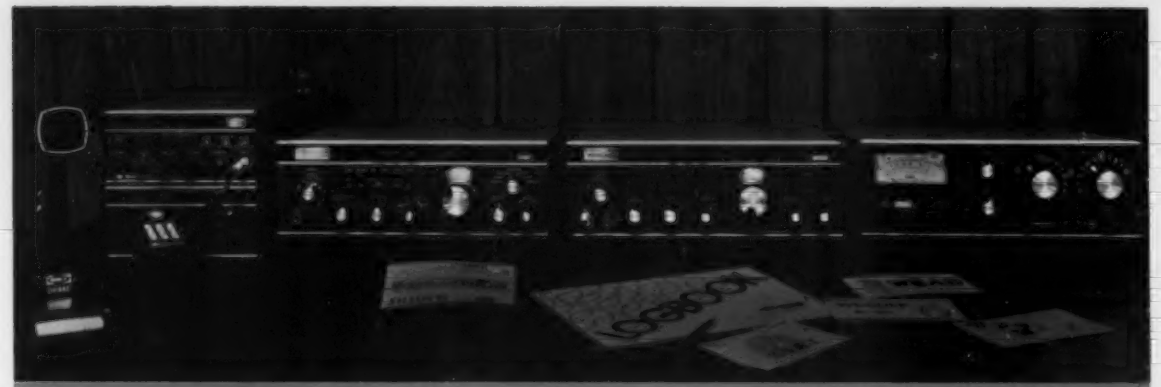
"Unlike field days in other areas of the world, you do not get to select your site. You are given a map reference and must hunt for your spot—and then try to get up some type of wire antenna for 40 and 80. Due to distances and conditions, verticals will not provide good results. A dipole is required for any degree of reliability.

"Usually, you do not get much chance to see any of the race activity because the cars come out of the bush, skid around a curve, slide to a stop, check in, and then roar off back around another curve into the bush again. Then there is the problem of crowd control. Little kids press around wanting to see what you are doing and are constantly in the way. Fortunately, the police, with a little judicious application of a switch from a nearby bush, usually can control the situation. The real kicker is when someone hears your call and





Before and after pictures of the editor's brand new quad. This was the result of the worst ice storm to hit Dallas in 30 years. The moral to this story is "Build it strong," even if you live in the sun belt. (Photos courtesy K5YUV)



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Model 1550 Drake DL-300

• **300 watts** for 30 seconds, with derating curve to 5 minutes • **Built-in PL-259 coax connector** for direct connection to rear of transceiver or transmitter-no jumper coax necessary • **VSWR of 1.1:1 max.** 0-30 MHz 1.5 max. 30-160 MHz • **Ideal as bench test device** for amateur or commercial hf and vhf gear. • **Small size** fits conveniently in any field service tool box. 6.7 x 2.08" (17.0 x 5.3 cm). **Wt.** 11 oz (310 g)

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✓ *Reader Service—see page 195*

tries to get a DX contact when you are having a rough time just hearing the control station.

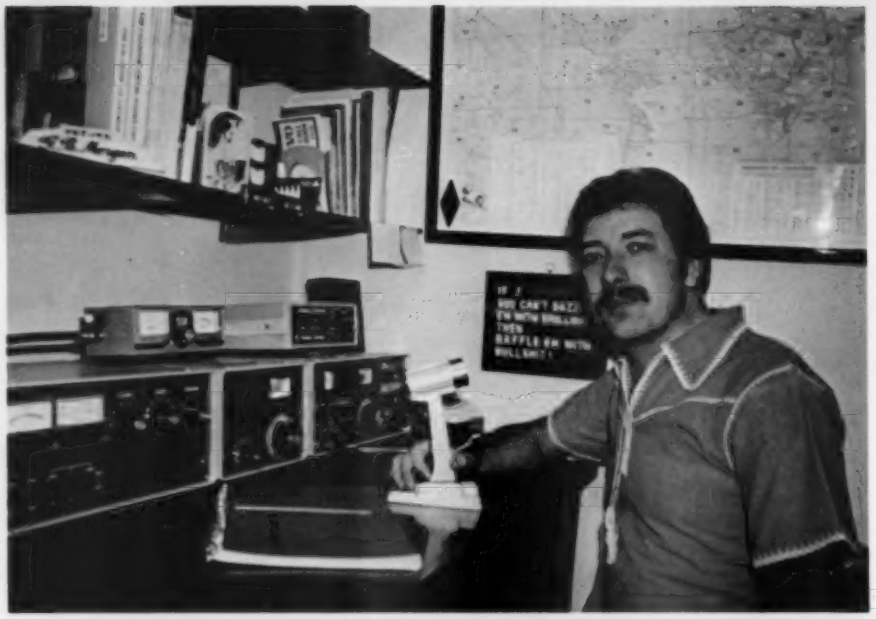
"In normal times, I enjoy giving DX contacts, especially to the JA boys. They are good operators and are very good in standing by when you are working someone. If you express any note of complaint about a station, there will be a burst of Japanese on the frequency and the trouble immediately disappears for good. I can't understand the words but the meaning is clear.

"Stateside operators are usually well mannered in pileups, but there are a few who never seem to get the word. Fortunately, they are few in number and it is simple to make a list of their calls and ignore them. Another method is to give them a report to get rid of them and then forget to log their calls. I have worked one station five times in this manner and he still doesn't understand (until now) why he's never in the log.

"The great benefit of amateur radio is the really nice people I have met, especially on the Afrikaner and Clinker nets. I've made numerous contacts with these fellows over the past seven years and enjoyed every minute. To make a list of the guys who have offered to give any help needed would require several pages of fine print. I once asked for a copy of FCC Form 610 and received a copy from five different guys. These responses make life enjoyable.

"I would like to see an award given for the best QSL manager and I would like to nominate my manager, W2PPG, for the first one. I don't understand why these guys volunteer their services, but from the DX station's point of view it is greatly appreciated. I am a lot more likely to stay in and give a report to everyone who is calling when I know I won't have to miss a week of operating time filling out QSL cards. These guys are the unsung heroes of DXing.

"Well, that about covers everything from over here in Kenya. My best 73 to everyone, and if anyone needs Kenya, look for 5Z4NH any day between 21.300 and 21.355 MHz."



Gary (Grenfell) Morgan HS1ALT (ex-VE3JKD) can be heard almost daily on 20m. The QTH is Bangkok, Thailand—the only country operating from zone 26. On Thursdays and Saturdays, from 1414 to 1430 GMT, the Canadians Overseas Net is in progress, with HS1ALT, VS6CZ, and 5H3BP doing the guidance. Join this net, and you can fill your log with such prefixes as 7P8, DU4, YB0, P29, G3, CN8, EL1, and VK, most of whom are Canadians abroad.

DX NOTEBOOK

Isle of Man GD/GT

DF7FH reports a planned DXpedition to the Isle of Man in July, 1979, to celebrate the 1,000th anniversary of the Isle of Man's parliament. During the first week of July, every station will be allowed to use the special GT prefix. They plan to operate from July 1st to July 15th on all SSB/CW bands. Operators include DF7FH, DK5FJ, DC1FP, DJ3BG, and YLs DF9ZG and DF9ZH. QSLs go to the individual operators.

Aves Island YV0AA

The Venezuela Amateur Radio Club is planning a DXpedition from April 7th to the 14th. Intended CW/SSB frequencies are 3525/3775, 7025/7085, 14025/14195, 21025/21295, 28025/28495-595. These are transmitting frequencies; listening frequencies have yet to be announced.

Heard Island VK0

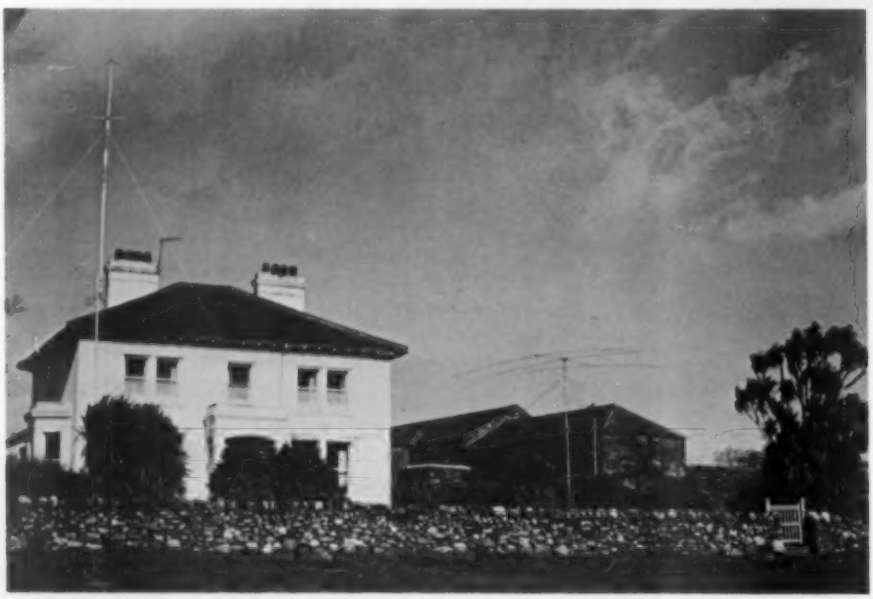
Several of the VK/ZL DXers have been gazing fondly toward Heard Island, and indications are that something may firm up before the year is out. Word has been passed that landing permission has been granted, transportation is on line, and even the callsign, VK0HI, has been issued. The last Heard Island activity was VK0HM back in the dark ages of 1970.

Christmas Island VR3AH

The following letter from WB4PRU gives some information and operating habits for those needing VR3AH:

"I am the QSL manager for VR3AH. I would like to pass along some sked times and

Continued on page 30



DXpedition QTH on the Isle of Man for the June/July operation by DF7FH, DK5FJ, DF9ZG, DF9ZH, DC1FP, and DJ3BG.

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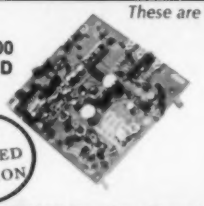

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- Same as used on SCR1000
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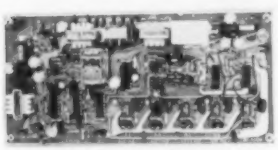

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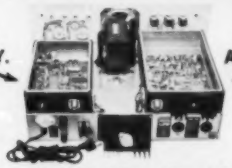

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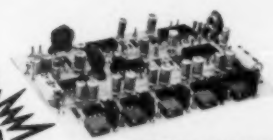

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RTTY Loop

Marc I. Leavey, M.D. WA3AJR
4006 Winlee Road
Randallstown MD 21133

Over the last several months, we have been investigating the components of a solid-state RTTY "stunt box," in hopes of putting together some kind of test equipment to send "THE QUICK BROWN FOX JUMPS OVER THE LAZY DOG." Along the way, it has occurred to me that even a simple identifier would be nice, like a "DE WA3AJR" or something. Hopefully, by the end of this month's column, we will be able to put something concrete together.

To date, we have covered interfacing to a loop (January, 1979), matrix encoding (February, 1979), and the UART with its associated circuits (March, 1979). If you are not familiar with these concepts, I suggest you check back to the indicated issues of 73. If all is OK, plow on!

Let's start with the matrix. Assume space for encoding fifteen characters, with a switch to select which character is to be sent. You would have something like Fig. 1. Now, besides being expensive, fifteen-position switches are hard to turn using TTL voltage levels. So what we will use is the electronic version of a fifteen-position switch, a 74154 data distributor, shown in Fig. 2. By grounding both the enable and data input lines, the output selected in binary will go low. Now all we need do is provide the binary code to the input and watch the data select. By the way, before you get all huffy, I know that there are really sixteen outputs from this chip, but we will need the last one later. The binary code input can be provided by a binary counter chip, such as the 7493. The beginnings of a system can be seen in Fig. 4, where the counter sequences the data distributor, which subsequently selects the matrix element.

"OK, smarty," I hear you say, "where do we get the pulse to trigger the counter?" From the UART, naturally! Reviewing the inputs and outputs of the UART, one finds a pulse on pin 22 which goes high when it's all right to load a new character. Sounds useful, no? Just as useful, we shall see, is a signal output which signifies completion of transmission of the current character.

Enough of the preliminaries. Let's throw in some more gates to control all this logic and come up with something like the suggested circuit in Fig. 5. It's not too hard to dissect this rather formidable circuit if you start at one side and proceed through it, gate by gate. On the right we have a push-button, used to start things off, which is suitably debounced and conditioned into the negative pulse needed to start the UART off. This pulse is passed through two gates on the way to the UART: an OR gate which will accept either the push-button or UART signal to trigger the UART, and an AND gate, used to turn the whole thing off at completion of the message. As soon as the UART starts sending the character presented by the matrix, an "OK TO LOAD" signal appears on pin 22. This is sent to the counter, advancing one count, and presenting the next character to the UART. When transmission of the current character is completed, an "OK TO SEND" pulse appears on pin 24 and is used to trigger the UART to send the next character. When the last character in the matrix is sent, the next advancement of the counter selects the sixteenth line (I told you I would get around to it!) and grounds it. By using that line as one input of an AND gate and the "send" signal as the other, one can block the "send" by providing a logic "0" to the other input of the AND gate. That is, with a logic "1", as will be provided when the last character is *not* selected, the output of the AND gate will follow the input. A logic "0" on one input of an AND gate inhibits *any* output from the gate. Fig. 6 demonstrates this for the disbelievers in the crowd.

If one wished to send just a test, say "RYRYRYRY . . . ," quite a bit of simplification could be envisioned. Only two rows of a matrix would be needed, and a simple flip-flop could select the row in use. Further, a "start" and "stop" control could be integrated with one more bounceless push-button. Fig. 7 offers some suggestions along that line.

Expanding the data to more than fifteen characters is also possible, but is a bit more complicated. Fig. 8 is one possible solution. Here we have used an additional 74154 as a true data distributor which selects which bank of matrices gets selected. For now, this shall remain food for thought.

Are you all ready for the

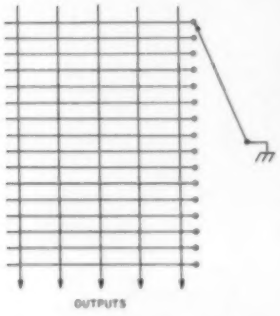

Fig. 1. Mechanical matrix selection.

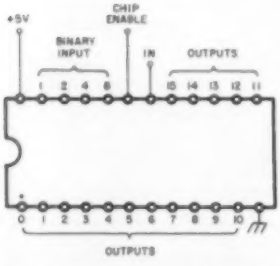

Fig. 2. 74154 data distributor pinout.

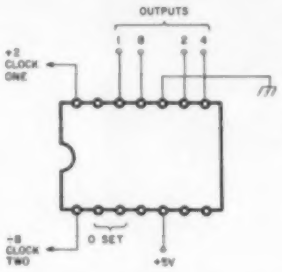

Fig. 3. 7493 binary counter pinout.

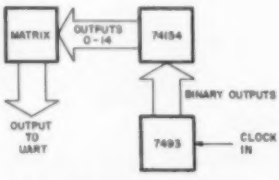

Fig. 4. Data selection basics.

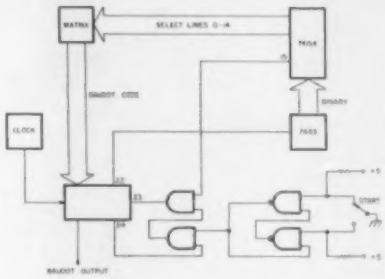

Fig. 5. Basic "stunt box."

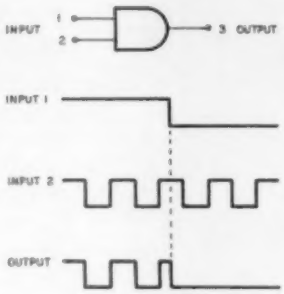

Fig. 6. AND gating.

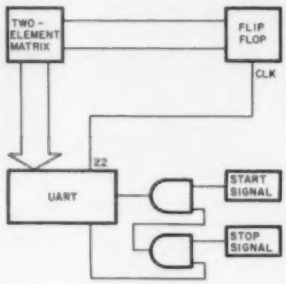

Fig. 7. 2-element generator.

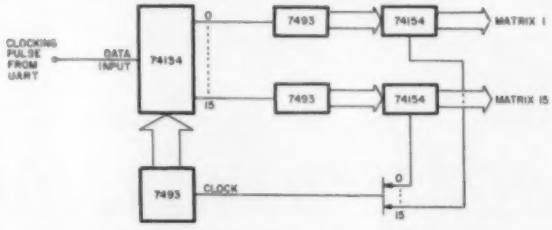

Fig. 8. Banking matrix using a 74154.

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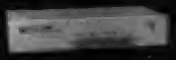

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Video Generator

1974

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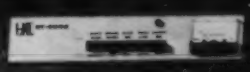
1976

1977

1978

DS3000 KSR Version 3
1st 3-mode Amateur Send-Receive Terminal
for Baudot, ASCII, and MORSE

1979



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record? The single item to draw the most response which I have ever mentioned in the two years of this column was the question as to the whereabouts of the *Green Keys* and *RTTY Journal*. While no one seems to know what happened to the *Green Keys*, oh, boy, do you all know about the *RTTY Journal*. I received numerous notices that it is *not* dead, although the exact state of its health was questioned by many readers. If you're interested, you might drop a line to: *RTTY Journal*, PO Box RY, Cardiff-by-the-Sea CA 92007. Subscriptions are currently $5.00 per year for the US, and $6.50 per year for Canada and Mexico. Foreign rates are also available.

Many thanks to the many hams who sent along information about *RTTY Journal*, including Larry Filby K1LPS, Mark Wilson W0ZSU, Howard Markwell W0MT, and John Langtry, who did not give his call but hails from Ontario. John also related that there is a Canadian RTTY magazine out, published by Gwen Burnett VE3AYL. Called *RTTY News*, the magazine is a monthly. Information is available from Gwen at: 85 Fifeshire Road, Willowdale, Ontario, Canada M2L 2G9. Mention RTTY Loop when you write her, okay?

To the many readers who have written in questions and requested personal answers: By the time this is published, I should be essentially caught up. That means that if you have written me and enclosed a self-addressed stamped envelope prior to one month ago, you should have received a reply. I discovered my two wonderful kids going through Daddy's desk and "sorting mail." I don't think I've lost anything, but if you have not received a reply, it is possible.

That SASE bit is not just for me, by the way, but is common courtesy whenever you write any author whose work you enjoy and from whom you desire a personal answer. That should go for not only articles you read here, but even those in (shudder) other magazines.

Next month, we will get to some of those burning questions sent in by the readership as we complete our second year of RTTY Loop. When we pick it up again, in June, we will add the second half of the program covered last year, sending RTTY with a microcomputer. Again, while the program will be written for one specific microprocessor, I hope to present it well enough so that it may be adapted to other popular systems.

Microcomputer Interfacing

David G. Larsen
Peter R. Rony
Jonathan A. Titus
Christopher A. Titus

DATA ACQUISITION

The software in the previous column provided an example of a program used to acquire a single analog point in digital form. We are generally interested in applications in which a series of points are to be acquired, stored, displayed, and perhaps manipulated. This month's column will explore the use of microcomputers for data acquisition.

In our discussion of microcomputer-assisted data acquisition, we shall assume that the analog-to-digital converter (ADC) is interfaced as shown in the previous column. The software, which is repeated in Table 1, is also assumed to be the same. The digital value of the analog voltage is returned in the B and C registers (register pair B).

In most data acquisition programs, a fixed number of points are to be acquired over a fixed period of time. In our example, 100 points will be taken, one every second. The 100 data points will be stored in read/write memory so that they may be used later. In writing data acquisition software, we are now faced with three tasks which must be performed in addition to the actual ADC task: 1) provide a software counter to count 100 points; 2) provide a one-second timer; and 3) provide software to store the data values.

The software necessary to count the 100 acquired points will actually count 100 passes through the data acquisition software. A general-purpose register within the 8080 chip is well suited for this; conditional jump instructions may be used to detect when the count is decremented to zero. The counter may be either incremented or decremented, but decrementing is probably easiest to use if you are just starting to program microcomputers. Storing the data in memory is not difficult. Once the converter value is stored in a register pair, the H and L registers (register pair H) may be used as memory pointers to point to a R/W memory location. Note that a complete 16-bit address must be specified for the MOV M,*r* instructions. Since the data is acquired from a 10-bit ADC, two successive memory locations must be used to store each *point*. The INXH instruction (increment register pair H) provides an easy means of pointing to the next successive memory location. We will store the data by placing the eight least significant bits in location n and the two most significant bits in location n + 1.

The one-second timer may present some problems, depending upon the type of system which will be used. It is relatively easy to write a one-second software delay program using a series of register-decrementing loops, nested one within the other. However, this means that to accurately time a one-second period, the computer must be doing nothing else. In a system which is dedicated to data acquisition for the 100-second period, such a procedure is valid. If interrupts occur or if the computer cannot be allowed to "do nothing" most of the time, an alternate solution is needed. One possibility is to use an external clock, often called a *real-time clock*. Real-time clocks are unaffected by computer execution times, interrupts, slow I/O devices, etc. Once started, they will continue to run at an accurate rate until they have timed the particular period of interest and sent an in-

Continued on page 155

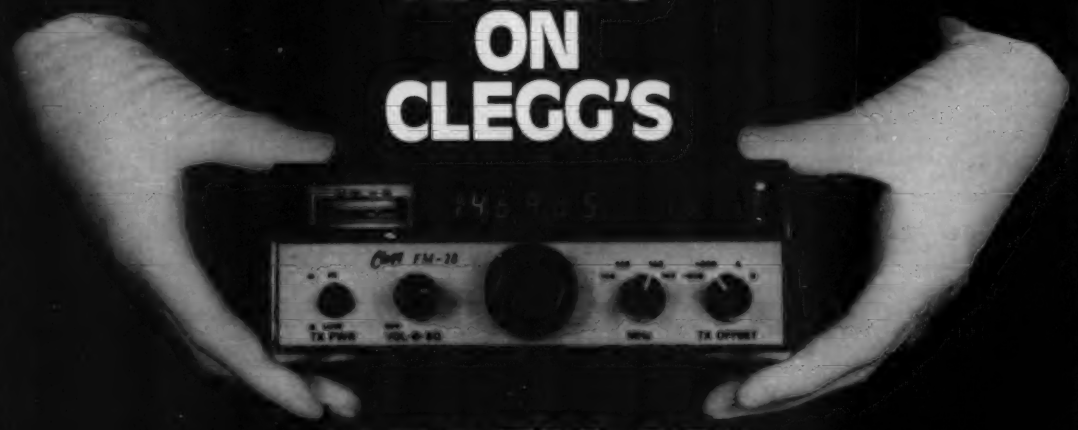
```
                        *100 000
100 000 365   ADC,    PUSHPSW /SAVE REGISTER A & FLAGS
100 001 323           OUT     /STROBE THE ADC TO START A CONVERSION
100 002 037           037
100 003 333   TEST,    IN      /INPUT STATUS BIT AND 2 MSB'S
100 004 066           066
100 005 306           ADI     /ADD 1 TO THE FLAG BIT
100 006 200           200     /TO CAUSE A CARRY IF IT IS SET
100 007 322           JNC     /NO OVERFLOW, CHECK IT AGAIN
100 010 003           TEST
100 011 100           B
100 012 107           MOVBA   /OVERFLOW, FLAG=1, SO SAVE MSB'S
100 013 333           IN      /INPUT THE 8 LSB'S
100 014 065           065
100 015 117           MOVCA   /STORE THEM IN REGISTER C
100 016 361           POPPSW  /RESTORE REGISTER A & FLAGS
100 017 311           RET     RETURN TO MAIN PROGRAM
```

Table 1. Typical ADC input routine for a 10-bit analog-to-digital converter.

```
                        *070 000
070 000 061   START,   LXISP   /LOAD THE STACK POINTER
070 001 377            377
070 002 070            070
070 003 041            LXIH    /LOAD THE DATA STORAGE STARTING
070 004 000            000     /ADDRESS IN REGISTERS H & L
070 005 072            072
070 006 315   CONVRT,  CALL    /CALL THE ADC SOFTWARE
070 007 000            ADC     /SHOWN IN TABLE 1
070 010 100            B
070 011 161            MOVMC   /STORE THE 8 LSB'S TO MEMORY
070 012 043            INXH    /INCREMENT THE MEMORY POINTER
070 013 160            MOVMB   /STORE THE 2 MSB'S TO MEMORY
070 014 043            INXH    /INCREMENT THE POINTER AGAIN
070 015 175            MOVAL   /GET THE LOW ADDRESS VALUE
070 016 376            CPI     /COMPARE IT TO THE 201ST ADDRESS
070 017 310            310     /310 = 200 DECIMAL
070 020 312            JZ      /DONE YET?
070 021 047            DONE    /YES, JUMP TO "DONE"
070 022 070            B
070 023 315            CALL    /NO, DO THE 1 SECOND DELAY
070 024 031            DELAY
070 025 070            B
070 026 303            JMP     /AFTER THE DELAY, GET THE NEXT
070 027 006            CONVRT  /ADC DATA POINT
070 030 070            B

                        /THIS IS THE ONE SECOND TIME DELAY
                        /SUBROUTINE

070 031 365   DELAY,   PUSHPSW /SAVE REG A & FLAGS
070 032 325            PUSHD   /SAVE REGISTERS D & E
070 033 021            LXID    /LOAD COUNTER REGISTERS
070 034 000            000
070 035 110            110
070 036 033   DEC,     DCXD    /DECREMENT THE REG PAIR
070 037 172            MOVAD
070 040 263            ORAE
070 041 302            JNZ     /IF NOT ZERO, DO IT AGAIN
070 042 036            DEC
070 043 070            B
070 044 321            POPD
070 045 361            POPPSW
070 046 311            RET

                        /THE PROGRAM WILL CAUSE THE COMPUTER TO
                        /JUMP HERE WHEN IT HAS ACQUIRES ALL THE
                        /DATA POINTS.  A DISPLAY OR OTHER ROUTINE
                        /MIGHT BE PLACED HERE INSTEAD OF THE HALT

070 047 166   DONE,    HLT
```

Table 2. 100-point data acquisition routine for one point per second.

GET YOUR HANDS ON CLEGG'S



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New Products

HAL'S NEW DS3100 ASR

HAL Communications Corporation has announced a new electronic RTTY terminal—the DS3100 ASR. The new terminal features full buffering of both received and transmitted data, thus permitting preparation of transmit text while receiving, as well as storage of up to 150 lines of received text and 50 lines of text to be transmitted. The new terminal also features a new screen format with 24 72-character lines split to show both receive and transmit buffers, line numbering for each buffer area, on-screen status indicators to show terminal code, rate, mode, etc., and a new high-contrast green P31 phosphor screen for easier viewing. The screen also uses bright/dim intensity changes to differentiate between keyboard and received data. A total of 10 HERE IS programmable identifier messages are available, two of which can be saved even while power is removed from the terminal. An IDENT feature allows Morse identification regardless of the terminal's selected data code.

Other features include a real-time clock, programmable answer-back (WRU), upper- and lowercase ASCII, ASCII speeds from 110 to 9600 baud, four keyboard-operated output switches to control accessories, and a full 25-pin modem connector for ASCII computer connections. As did the previous DS3000 KSR V3 terminal, the new DS3100 ASR will send and receive all three data modes (ASCII, Baudot, and Morse), allows use of continuous, line, or word transmitting modes, and has synchronous idle, unshift on space, and word wrap-around. Both the electrical and mechanical features of the terminal have been completely redesigned to use a Z80 microprocessor and plug-in circuit boards, and to allow easy service. A front-face legend has been added to the keytops to fully label all control functions of the terminal and simplify operation. The keyboard and new streamlined cabinet are color-coordinated in a new two-tone castle tan and chocolate brown finish.

The terminal weighs 45 pounds and can be connected for use with 120 or 240 V ac, 50- or 60-Hz power mains. The cost is $1995.00, including shipping within the United States; deliveries of the first units will start before May 1, 1979. For further information, contact *HAL Communications Corporation, Box 365, Urbana IL 61801; (217)-367-7373.*

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How accurately are you pointing your beam? Until recently, I thought I was doing a pretty good job of pointing mine. Oh, sure, I was using one of those standard charts centered on the nearest big city (Boston in my case), but I always figured that was close enough. Now I've changed my mind, thanks to the superb selection of beam heading charts offered by Bill Johnston N5KR.

For more than a dozen years, Bill has been supplying hams with the real McCoy: Great Circle bearing charts centered on the exact QTH you specify. No more guesswork. . . no more trying to make do with a chart centered hundreds of miles from your QTH. The amazing thing is that Bill can send you his basic chart for just $1.00. What do you get for a buck? The basic chart gives you beam headings from your QTH to 660 cities, countries, and islands around the world. The listings are evenly split between DX and domestic locations. The chart also shows the distance to the other QTH in both miles and kilometers, as well as the beam heading the other fellow should be using to maximize his signal to you. All this for $1.00!

I compared Bill Johnston's $1.00 chart to another I'd seen advertised for $4.95. The $4.95 chart was the loser by a wide margin. It listed only 332 different locations, and if you don't live near one of 51 American population centers, you're out of luck, because the charts are not customized to your QTH.

Bill Johnston has recently expanded his offerings, which now include enlarged DX and US beam heading charts, OSCAR/RS acquisition charts, geosynchronous satellite pointing charts, computer-generated code-practice groups, and even a computer-drawn Great Circle map centered on your QTH. All are reasonably priced. *Bill Johnston N5KR, 1808 Pomona Drive, Las Cruces NM 88001.*

Jeff DeTray WB8BTH
Assistant Publisher

THE DIAL SPOTTER

At last, we hams and shortwave listeners have a digital product which puts new useful life into our old general coverage receivers and makes logging a snap. The Dial Spotter by Gemini Instruments enables you to quickly and easily read frequency within 1 kHz from 1 kHz to 35,000 kHz. The beautiful part about this instrument is that it adapts to any 455 kHz receiver whether it has a plus or minus or both offsets on the high frequency oscillator. My DX 160 receiver has a minus offset on the lower frequencies and a plus offset on the 13-to-30 MHz range. To change offsets on the Spotter, you simply throw an external switch which gives you additive or subtractive mixing.

The installation of the unit is quite simple. The Dial Spotter comes with an ac power supply and simply plugs in. The most difficult job is taking your receiver out of its cabinet so that you can add a simple connection. You don't butcher your receiver in any way, but just add a condenser lead out to a phono jack. The Dial Spotter comes with either 110 ac or batteries. The appearance is excellent. The readouts show up brilliantly in light and are large enough so that you do not have to squint to read them. After several weeks of use, I am delighted with its performance. There is stability in the readout, with little or no roll, and it beautifully follows your tuning.

If you are looking for a digital

The Dial Spotter.

Stoner's Model PRO-10.

readout to update your receiver, this is it. Shortwave listening becomes a pleasure, since you can quickly go back to a station or find a new station. The unit has an internal switching system which enables you to correct for a difference in i-f frequency of plus or minus 4 kHz. Thus, if your i-f is off a little from 455 kHz, you can make corrections after installation. Calibration is simple, as all you have to do is tune in a WWV or local broadcast station and adjust the switches. The calibration holds permanently.

The Dial Spotter is not a totally new design. It has been used in a slightly different configuration as the Navigator Mate, which is used by boaters for frequency readout on their portable RDF/ADF receivers. The unit weighs 6 lbs., measures 10½" x 2½" x 11", and comes with ac, 4- or 5-digit readout, black anodized finish, and several options. Also included is an excellent instruction manual.

For further information, write the *Gemini Instrument Co., Box 205, Larchmont NY 10538.* Reader Service number G27.

Wells R. Chapin W8GI
Kingsley MI

FIRST HAM RADIO WITH AMPLITUDE-COMPANDORED SPEECH

Stoner has just introduced the first amateur radio transceiver to employ amplitude-compandored speech. Officially called the Model PRO-10, it has been dubbed "The Black Widow" by those who have seen and heard it operating on the 10 meter band.

The impressive performance of the radio is the result of a tiny integrated circuit from Signetics. The "chip" contains the equivalent of a six-foot rack of tube-type telephone-circuit speech-processing equipment.

Amplitude compandoring involves logarithmic speech compression and expansion with no audible distortion. Part of the IC compresses the speech to raise the average modulation and "talk power." The other half of the Signetics "chip" is used to expand the voice on receive. The company stresses that both the incoming and outgoing signals are enhanced significantly even when the PRO-10 communicates with conventional SSB radios. A technical paper on amplitude-compandored speech is available from STONER upon request.

The PRO-10 is described by the company as a "platform" for high-technology SSB concepts. It operates on 10 meters. The SSB/AM/CW transmitter features 100 Watts minimum power output over the entire band. The receiver has a sensitivity of 0.5 microvolts for a 15 dB (S + N)/N ratio. A built-in six-digit frequency counter, which reads ± 100 Hz, features jumbo 0.5"-high LEDs.

The PRO-10 also features state-of-the-art electronic tuning (fast or slow) from either the panel or the microphone. A PLL (phase locked loop) tunes the radio in 10-kHz steps, while a vfo provides continuous tuning (1 kHz per turn) between steps. A built-in memory stores the last frequency used when the radio is turned off. Break-in CW operation is provided by carrier offset (50 Watts power output).

Another feature of the PRO-10 is the inclusion of amplitude modulation (AM). Noting the popularity of converted CB radios on 10 meters, Stoner incorporated a provision for this mode by employing a dual-bandwidth (2.5- and 5.0-kHz) crystal filter. The carrier output is 25 Watts. The operating mode (U, L, or A) is indicated by an LED to the right of the frequency display.

The PRO-10 measures 9" W, 8" D, and 3.25" H, an ideal mobile configuration. The power required is 13.6 V dc at 5 Amperes average current.

Stoner—The Sideband People, John Hancock Building, Mercer Island WA 98040; (206)-232-9464. Reader Service number S85.

NEW "BEARCAT® 211" SCANNER HAS 18 PROGRAMMABLE CHANNELS

A new, crystal-less scanner radio with 18 channels which can be programmed with push-button ease has been announced by Electra Company. Named the "Bearcat 211," the new radio also features direct channel access which allows the user to manually select channels directly, without the need to step through other channels. In the radio's automatic scan mode, the 18 channels can be scanned at either 5 or 15 channels per second, permitting closer monitoring of desired frequencies. Also included is a patented selective scan delay which permits a 2-second delay to be programmed for any channel, allowing reply calls on the same channel to be picked up.

The new Bearcat 211 scanner radio also features a built-in digital clock function utilizing the radio's bright-red LED digital display. The high accuracy clock shows hours, minutes, and seconds. Another feature built into the new radio is automatic squelch. This feature allows the convenience of selecting a factory pre-tuned squelch level eliminating the need for manual squelch-level adjustment.

Thousands of frequencies in six bands are covered by the new Bearcat 211. Included are public safety, marine, government, transportation, and amateur communications. In the radio's "search" mode, the radio will seek out active frequencies between the limits selected by the user. Electra Company's patented Track Tuning is used to provide optimum reception across wide frequency bands. Complete details on the new Bearcat 211 scanner are available from Bearcat scanner suppliers or by writing to *Electra Company, PO Box 29243, Cumberland IN 46229.* Reader Service number E40.

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The new Bearcat 211 scanner.

Contests

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is the only indication of amateur interest the Bermuda Dept. of Tourism has.

COUNTY HUNTERS SSB CONTEST
Contest Periods:
0001 GMT Saturday, April 21 to 0800 GMT Saturday, April 21
1200 GMT Saturday, April 21 to 0800 GMT Sunday, April 22
1200 GMT Sunday, April 22 to 2400 GMT Sunday, April 22

Please note the two four-hour rest periods!

This is the 8th annual contest sponsored by the Mobile Amateur Radio Awards Club, Inc. Mobile stations may be worked each time they change counties or bands, but, if worked again from the same county on a different band, count for point credit only. Mobile stations contacted on a county line count as one contact but two multipliers. Portable stations will be considered *fixed* stations. Fixed stations may be worked by other fixed stations only once during the contest regardless of bands. Repeat contacts between fixed stations on other bands are not permitted! Fixed stations may be worked by mobile stations each time they change counties or bands. Repeat contacts between mobile stations are permitted provided they are on a different band or in a different county.

EXCHANGE:

Signal report, county, and state (country for DX). Mixed mode contacts are permitted provided that one station is on SSB. (Mobiles, please keep an ear for CW county hunters calling!)

FREQUENCIES:

3920-3940, 7220-7240, 14275-14295, 21375-21395, 28575-28595. Look for mobiles on 15 meters on even numbered hours.

Please note: Again, this year there will be a "mobile window" of 10 kHz on the following frequencies: 3925-35, 7225-35, 14280-90. Mobiles will be in this 10-kHz segment and fixed stations are asked to refrain from calling "CQ Contest" in this segment. After working mobile stations in the "window," fixed stations are requested to tune and work other mobile stations or QSY to the outer edges of the suggested frequencies to call CQ or work other fixed stations in the contest. This will allow the mobile running lower power a chance to be heard and worked in the contest.

SCORING:

Contact with a fixed/portable US or Canadian station = 1 point. Contact with DX stations (including KL7 & KH6) = 5 points. Contact with mobile stations = 10 points. Multiplier is total number of US counties plus Canadian stations worked; take credit for a county only the first time it is worked. A Canadian station counts each time it is worked. Final score is total number of QSO points times total number of different counties and VE stations worked.

ENTRIES:

Logs should show date/time in GMT, station worked, report exchanged, county, state, band, claimed points (1, 5, or 10), and each new multiplier numbered. Official log sheets and summary sheets are free for a #10 SASE or SAE and appropriate IRCs from John Ferguson W0QWS, 3820 Stonewall Ct., Independence MO 64055. Submit all entries to the same address no later than June 1 to be eligible for awards; DX should use air mail.

AWARDS:

Plaques to highest scoring fixed US or VE, DX, mobile, and 2nd mobile; certificates to top 10 fixed and mobile stations in US and VE and to the highest scoring DX in each country. Only single-operator stations are eligible for these awards, but multi-op certificates may be issued if merited. A station may enter as both fixed and mobile, but separate scores are required.

WORKED ALL SOUTH EAST AWARD (WASE)

This award is offered by the Southeast Amateur Radio Club of Cleveland OH. An attractive certificate is available to all amateur radio operators who QSO with at least three members of the club on any band below six meters. Members of the club will be on 14.30 MHz every Wednesday evening starting at 0130 GMT. The club also meets on 28.70 MHz at 0130 GMT each Sunday evening for its weekly club net. To get your WASE certificate, send an SASE along with the callsigns of three club members and the date of each QSO to: WASE, c/o WD8KIS, 2196 South Overlook Road, Cleveland Heights OH 44106.

Looking West

from page 8

amateur band had little to no activity to speak of, depending upon where you lived. Remember that it's been but two short years since 220 started to come into its own—as a result of two happenings.

Happening one was the severe overcrowded conditions which developed on the two meter band in localities such as southern California, New York, metro Chicago, and a few others. Amateurs wanted to get away from these conditions and started to look elsewhere. Many migrated to 450, but in some places, especially southern California, that band, too, was very crowded. Starting first in southern California, amateurs began to look at 220 as an alternative.

This was the spur to the second happening. Recognizing that amateurs were giving 220 notice, a number of manufacturers began to produce equipment for the band which was popularly-priced. Just as Heath was credited with "making" six meters years ago, companies such as Midland, Clegg, Wilson, and Cobra will go down in the amateur annals as the pioneers of 220.

By the time the 220 Class E proposal came to fruition, amateur operation had begun to entrench itself on that band. And by the time the FCC announced that the proposal was no longer viable, we had run out of 220 repeater pairs in southern California. Even if the proposal had gone through, it would have been all but impossible to implement here.

There was one fly in the ointment, though. 220 CB might have been approved had not our neighbors taken issue with the idea. They had witnessed the 27-MHz mess and did not want an expanded version of it. Maybe, had the US been able to guarantee that it would have been a totally-structured, heavily-policed service, it could have passed, but even the most bureaucratic of bureaucrats would have thought twice about that one. So, much to the dismay of many manufacturers who had hoped that 220 would be a needed shot in the arm for the teetering CB industry, 220 Class E died. If the ARRL had said nary a word, or even if they had supported the idea, it probably would have died the same death.

There is a difference between the Class E CB proposal and the current US WARC proposal pushing maritime mobile. Unlike CB, maritime will be looked at as a structured and policed service. Moreover, this is not a proposal for a given nation, but rather for the entire world. Now, when you "lose one," as happened with Class E CB, you do not go out to get egg on your face again. The FCC "lost" in the Class E fiasco, so they are not about to take that chance again unless they thought they had a viable proposal. This means that they would at least expect support from throughout the region. I believe that the ARRL will be looked upon as no more than a radio club—unable to take on an entire region. They are just not that powerful. It would be nice if they were, but such is not the case. If they had taken the initiative years back and invested in a professional lobbyist rather than a new office building, they might have developed the necessary structure to fight such transgressions as these. In fact, had the ARRL developed an effective lobby in Washington, we would not now be facing crisis after crisis.

There is another important factor. The ARRL just does not have the overall support of our VHF community. The world of VHF communication is fascinating and fast-moving—especially that of VHF/UHF relay technology. Yet the ARRL has always been slow to react to the needs of that segment of the amateur society. In most cases, they have acted "after the fact." I seem to remember that half of the national number of repeaters had been coordinated along a 2 meter band plan before the ARRL got around to endorsing one. What is called the ARRL Band Plan for "2" is, in actuality, the Modified Texas Plan. Later, after the ARRL recognized that inverted tertiaries worked better than right-side-up ones, the Southern California Band Plan suddenly became incorporated in the ARRL one. Another recent ARRL acquisition has been the band plan for the 144.5-145.5-MHz subband. This is actually the NARC or Northern Amateur Relay Council Band Plan; it was not dreamed up by the ARRL. There is nothing original in the ARRL 2 Meter Band Plan. It consists only of what they have borrowed from others and attached their almighty name to.

If the ARRL were the true VHF/UHF leaders, they would have developed band plans for all spectral activity long before they were necessary. They didn't, and to date they have not come up with anything

original. They borrow and endorse but they fail to create. Part of the job of a leader is to be imaginative enough to plan ahead. They have not, and because of this, they cannot gain the support of the majority of the VHF/UHF community.

Another graphic example of the lack of leadership is the League's reluctance to enter into the realm of total spectrum management. This is a concept that the League should have pioneered. Instead, the idea developed from a single small regional repeater council, the SCRA. In fact, the SCRA (under its new title, 2mASMA) evaluated, modified, accepted, and implemented the recommendations of the ARRL's VHF/UHF Advisory Committee's proposed national 2 meter bandplan while the ARRL's Board of Directors debated its merits. It's a good plan, and with only one slight modification, it truly serves the needs of all 2 meter users. This plan should have been implemented nationally a long time ago, yet we still await Newington's decision. Southern California elected not to wait. Other areas, including the Southeast, seem to be reaching the same conclusion and are proceeding without Newington's okay.

All this comes down to the fact that the ARRL is not being effective enough as a VHF/UHF leader. And without support from the VHF/UHF masses, there is no way for them to obtain the stature necessary to dissuade the rest of the region and possibly the world from doing anything they want. 220 marine is just another example of this—and it may be the straw to break the VHF world's back. Those whom I have spoken with want no part of the ARRL in the fight to save 220. They feel more secure in going it alone than they do with the quasi-support of the ARRL. If the amateurs are able to fight off this latest threat to 220, the ARRL will again probably try to steal the spotlight. If 220 is lost, it will also mean an end to *any* support for the ARRL by those involved in VHF/UHF relay communication—and that's a big chunk of the amateur population.

HOW CAN THIS BE CHANGED?

There are two organs within the ARRL which could become the VHF/UHF leaders of tomorrow if the ARRL Board of Directors would let them. They are the VHF Repeater Advisory Committee and the VHF/UHF Advisory Committee. However, they both seem continually stifled by the bureaucratic attitudes of the ARRL Board of Directors. Eventually, because of this lack of Board initiative, some of those who have served on the VRAC have felt that they have had enough and have left. Can you blame them? Put yourself in the position of being an advisor to their Board on matters with which the Board was a bit unfamiliar. You were selected because of your knowledge of VHF/UHF communication and were told to advise the Board on such matters. The committee itself exists because the Board knows little about the topic. If they were experts on it, why would they have the advisory committee in the first place: By forming such committees, the ARRL Board admits its knowledge deficit in such areas.

So, you research something. Let's say it's a band plan for six meters. You present it to your fellow committee members and they agree. Your chairman then forwards this committee recommendation to the Board, where it is formally pigeonholed. Eventually you give up and do one of two things. You protest and quit, or you become a good little boy and enjoy your status as a committee member while doing as little as you can. Frankly, I can't blame anyone who does either under the current scheme of things. However, there is so much potential in both the VRAC and the VUAC that it's a shame to see all this talent wasted. It *can* be changed, and here is one way:

First, both the VRAC and the VUAC have to be taken out from under the Board of Directors' thumb. Members of both committees should not be appointed through Newington, but rather should be elected on a Division basis as are Division Directors. It would then be the people rather than the bureaucrats speaking. Within this elected body, another election should be held to determine a chairman and a liaison officer. Decisions of such committees should then be presented to the ARRL membership and voted upon by the members as to whether such should or should not be implemented. The Board should keep its nose out of it, since by creating such committees, they admit that they are not at all adept at these matters in the first place. Once the roadblock caused by the Board of Directors is eliminated, the VRAC, the VUAC, and other expert League committees can go forth and help guide amateur radio directly.

The big question is: "Can it ever happen?" It's a simple, effective idea, but one that would dilute the Board of Directors' authority. I doubt that the current regime in Newington would buy it. Therefore, the real answer is a long-term one. It means voting into power individuals whose views are the same as yours. It means evolutionary change, and, unfortunately, we in VHF/UHF just don't seem to have the time to await such a happening.

As in the past, things keep going with or without the ARRL. They will continue to take credit for what we accomplish and we will keep on accomplishing with or without them. If we survive WARC, VHF and UHF will continue to grow and prosper. New ideas will continue to pour forth. If the ARRL announced today that it was pulling out of any further involvement in this part of amateur radio, it would not matter one iota. That's what makes the whole thing so sad.

COORDINATION: THE BEST METHOD YET

Gary Pearce WA9NSO is the Illinois Repeater Council's coordinator. Over the years, I have heard quite a bit about Gary, but it was not until recently that I had the pleasure of meeting him and finding out first-hand how the IRC faced an almost overwhelming problem and was able to conquer it. Here is the story, as Gary explained it to me over lunch in San Diego.

About a year ago, the IRC simply ran out of places on two to put repeaters. There were always far more requests for spectrum than there was space available. Eventually there was no more, even with co-channeling and similar measures. At this point, the idea was born in the IRC that it was time that it became an advisory rather than an administrative group. A new concept of repeater coordination took root, which I will term "advise and consent coordination."

According to Gary, someone coming to the IRC these days for a metro-area repeater on two does not get an exact assignment. Rather, he is given an accurate listing of all area activity and told to go forth and find himself a home which will cause minimal interference to himself and all existing activity. The rationale is that nobody wants to be interfered with, and thus the new repeater owner will seek a home which satisfies this criterion. This concept takes the responsibility for minimizing and/or eliminating interference and places it squarely upon the shoulders of the new system owner. In such cases, the IRC operates on an advisory level. If all goes well, it gives final consent to the system's establishment and operation.

After listening to Gary, I took the initiative and developed a similar plan for this area, which I presented to the 2mASMA Technical Committee. The Committee decided to give it a try. Some new forms to utilize the concept were developed and included in the coordination information packet which is sent to every new repeater applicant. The results have been amazing.

2mASMA administers a very large area, one of the largest in the nation. It is impossible for a committee meeting in LA to know every bit of spectral activity in this geographic area. At least half a dozen coordinations have been made using this system to date, and not one has come back to haunt us. In the past, at least two out of every six have—especially from the overcrowded LA-San Diego rf corridor which for years has been the crux of our problem. It's no longer simply a matter of requesting a channel pair. You must go out and find one upon which you can survive—and in this no-man's-land, that's not that easy. The burden for technical excellence is now on the amateur, rather than on the council committee, and that should eventually lead to better technical excellence on the air. For coordinators and/or coordination committees interested, an SASE to PO Box 2606, Culver City CA 90230 will bring a sample copy of the aforementioned self-coordination forms, which 2mASMA will gladly let you duplicate for your own use.

GROWING PAINS DEPARTMENT

One organization which has had its share of growing pains and is now emerging to a position of leadership in the world of hobby-service two-way radio is a group called H. F. International, with headquarters in Riverside CA.

Once regarded as a renegade CB club which promoted illegal, out-of-band, and overpower operation in the spectrum between the 11 meter CB and 10 meter amateur bands, HFI, now under new leadership, has emerged as an organization dedicated to serving the needs of the hobbyist SSB enthusiast, be he CBer or ham. There is a lot more to HFI than meets the eye, and now, and in the future, I hope to give you a bit of insight into that organization and the changes which have occurred within it.

I know that some of you will take issue with my devoting space in an amateur magazine to something not purely amateur- or VHF-oriented. Others may take the view that all HFers are nothing but illegal radio operators and must not be given recognition. Neither of these statements holds much water. There is one important

reason why you should know about HFI and its people: Many of them are transitionites, in the process of leaving CB and becoming amateurs. One of the avowed new goals of HFI is to educate the CBer of today so that he/she can be the good amateur of tomorrow. Then, too, 100,000-plus hobby radio operators make up a big chunk of today's personal communicators and, just as the US could no longer fail to recognize the existence of mainland China, we in radio cannot bury our heads in the hope that HFers will all just go away. The fact is that what is termed illegal radio operation between channel 40 CB and the low end of 10 meters is growing at a phenomenal rate; another goal of the new HFI is to try to curtail this.

Like most other amateurs, for years I have been very boisterous in expressing my indignation at any illegal operation. A year ago, if you had asked me who all those bad guys were, I would have said that they were all members of HFI. The fact is that I said that many times and to many people. One day I said it to another amateur, who simply giggled a bit. He called me back later to offer LW a chance to meet with the president of HFI and judge for myself. The meeting was arranged according to certain ground rules I set down. I was still feeling indignant. There were two things. First, it would have to be a no-holds-barred interview, in which I could ask anything I darn well pleased. The second condition was that I be permitted to tape-record the interview so that later on no one could deny that what was printed had been said. This was agreed to, and early last spring I drove to Riverside and met with Norm Muller and his wife Jeannie at their home (which also serves as HFI headquarters).

We spent a rather enjoyable afternoon just "rapping" with one another, breaking now and then to change a tape or get another can of cola. I had come with the typical "ham with a chip on his shoulder" attitude well entrenched, and I was ready to do battle. The war never developed. There was an instant rapport, and it turned out to be one of the most educational afternoons I have ever spent. More in future columns.

THE JOE MERDLER REVISITED DEPARTMENT

On Tuesday, January 9th, I received the following news release from Joe Merdler N6AHU: "On January 9th, 1979, Scott Lookholder WB6LHB pled guilty to three counts of violating section 1464 of Title 18, using obscene and abusive language as a misdemeanor. Maximum penalties are up to 1 (one) year in prison and up to a $5,000 fine on each count. Sentencing is set for February 6th, 1979."

Looking West will have more on this in the future. However, we do have a rather interesting sidelight to report now. As a result of running the text of Joe's San Diego speech last December, he has been reunited with a relative he never knew existed. Joe tells the story this way:

He was in QSO on 20 meters with AA6A discussing DX when a breaker was heard. The breaking station turned out to be K8AQA in Saginaw, Michigan. K8AQA asked N6AHU: "Would you believe my name is Merdler, too?" It turned out to be Robert Merdler, and, in the course of the QSO, the two realized that they were indeed cousins. On that happy note, we will end this month's Looking West.

CARF

Canadian Amateur Radio Federation, Inc.

The DOC has announced the following changes to agreements with other countries: Add Mexico to the third-party traffic list. Negotiations are under way for third-party agreements with Australia, Haiti, Jamaica, and Liberia.

Reciprocal licensing arrangements have been made with Austria, Barbados, Bermuda, Costa Rica, Honduras, India, Indonesia, New Zealand, the Philippines, Sweden, and the United Kingdom.

On the banned countries list, the Viet Nam exceptions XV5AA, XV5AB, and XV5AC have been eliminated.

The DOC is negotiating reciprocal licensing arrangements with Haiti, Italy, Liberia, and Spain.

Lists in copies of the CARF publication, *The Canadian Amateur*, should be amended to conform.

DX

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recommended operating habits. I keep a sked with Doug every Sunday he is available on 28031 kHz at 2000Z. When he has the time, Doug will hang around and work a few stations after our sked. Doug's general operating times are from 0500Z to 0800Z, on all bands 10 through 160. I have handled all QSLs since June 1, 1978. Prior contacts should go to K2BT. There was a very active pirate using Doug's call, so unfortunately some cards are being bounced back. Best 73, Greg WB4PRU."

Palmyra Island

This summer, one of the better-heeled newcomers to the DX fraternity plans to depart from California for a four-month tour aboard his yacht *Wildfire*. Planned stops are Hilo, Palmyra, and Christmas Island. He is definitely planning the Palmyra stop, and says if the weather permits, he will take a swing by Kingman Reef. This looks to be mainly a CW-type operation, since the operator is new to ham radio and has a CW background from the Navy. He is planning to devote much of his operating time to the Novice bands.

Chad TT8

F6FFQ is in Chad and has been signing /TT8 in the 14105 area. It is hoped that he can soon be persuaded to brave the storms above 14200.

Djibouti J28AY

WB4ENI passes along the following information on J28AY: Marc plans to QRT sometime in July of 1979, when he will return to France as F6ETO. Beginning in July, all cards should be sent to F6ETO's CBA. In the meantime, they can still be sent to the Djibouti CBA. Marc prefers CW because his English is somewhat fragmentary. Look for him on 10, 15, and 20.

Korea HL9TG

Gary writes that he will be in Korea until January, 1980, and plans to be active on SSB and CW, 6 through 80. Contacts after March, 1974, go to WA7NTF, 6419 158th Street CT East, Puyallup WA 98371 or directly to Gary Kohtala, USAFS-K Box 194, APO San Francisco 96271.

Afghanistan/Pakistan

OZ1CRH will be traveling to Afghanistan and Pakistan and is optimistic about receiving YA operating permission. He will be in Pakistan from March 15th to May 30th and plans to sign AP2LJ. QSL to WA8AJG.

Spratly 1S1B

The late word had the group departing Brunei on March 28th and landing March 30th. The plan is to operate until more than 30,000 QSOs have been logged. VK2BKL and ZL1ADI from the Mellish operation will be along, and the boat will be the same one used at Mellish.

Dodecanese Islands SV

Those needing the Dodecanese should be interested in the following letter from SV1IG in Athens:

"Please inform the readers of *73 Magazine* that I and my wife will be touring the Dodecanese Islands from July 1st to August 15th. There will be many difficulties, as not all the islands have transportation. Since some are without roads, we will not have a car either. We will operate all bands, but will concentrate on twenty meters at 14205 and 14285 kHz. QSL to Anastasios Panos, 4-6 Voltairou Street, Athens 411, Greece."

SV1IG also noted that he no longer holds office in RAAG at the awards department, so letters addressed to PO Box 564 in Athens will no longer be answered. Anastasios also mentioned possible SY Mt. Athos activity in 1980.

China

Rumor has it that at least two American amateurs have applied and received preliminary approval for operation inside The People's Republic. It has long been felt by some that the first legitimate operation from China would be by Chinese nationals, but who can tell? Work 'em if you hear 'em, and worry later.

Comoros D68AD

As an accommodation to those working toward 5BDXCC, Robin maintains regular skeds on 1804 kHz from 0230Z and on 3504 kHz from 0300Z.

Sao Tomé S9

Angelo D4CBS will have been on Sao Tomé for an extended visit which began in March. Although he holds a license and will be taking his rig with him, informal inquiries as to the status of amateur radio have

gone unanswered. Hopefully, by now you will be hearing Angelo from S9.

Pitcairn Island VR6

Things should pick up from Pitcairn on April 19th, when the *Yankee Trader* puts in on its latest around-the-world journey. Aboard will be K5UC, N1DX, and K0BJ, who has been issued the call VR6BJ. The idea will be to put VR6 on bands and modes not usually available. Planned are RTTY, CW, 40, and 80. Other RTTY stops will be CE0Z, 3D2, KH8 (KS6), and 8Q6. W0PAH will handle QSLs.

NOVICE CORNER

Although in the early stages of working DXCC it shouldn't be necessary to make schedules in order to work a new one, there may be instances when you want to ensure a contact with a certain station.

The best way to do this is to write to the station's QSL manager requesting possible schedule times and frequencies. Most QSL managers keep regular schedules with the stations they represent in order to pass logs or verify contacts. Often, the DX station will either show up early or else hang around afterward and hand out a few reports.

Remember, these QSL managers have plenty of work just keeping up with the QSL demand, so be sure to include an SASE with any correspondence. It never hurts to include paper as well. When schedule time comes, just let the QSL manager know you are on frequency and then stand by until all traffic has been passed. Then you can make a contact and the QSL manager will already have you in the log.

Just remember to be patient and follow instructions, and you'll usually be able to add a new one to your log.

HEARD ON THE BAND

4S7EA runs a Tuesday, Thursday, Sunday sked for the deserving DXer on 14247 kHz at 2330Z, with K9VAL as MC.

TR8AC is shooting for 2,000 QSOs per month with those deserving DXers in need of a TR8 contact. Look for him around 14222 after 2000Z.

Those new 8L2 prefixes are the old VP2L St. Lucia stations signing their newly-gained independence-type calls.

There are still two active operators on Johnston Island. KH3AA, the chief electronics technician for the installation there, is on generally once a week, and KJ6BJ can often be found around 14056 kHz from 0600Z. WH3AAA is reported to also be on the island and trying to upgrade.

The New Jersey DX Club has been supplying some needed manpower in an effort to reduce the QSL backlog at 4U1UN. They are having some success, but it never seems to be enough when you are among those in the waiting line.

Congratulations to new ARRL DX Advisory Committee members K5YY, K7LAY, and W0SR. They join holdovers W2XN, N6RJ, WB8EUN, K9AM, W3ZN, N4MM, and Chairman W1OT. Any complaints or bouquets you have concerning DX should be directed to these deserving ones.

Box 88 is slow but sure. K4IIF, who handles the *CQ Magazine* awards program, recently received six pounds of cards and applications from Moscow. The applications included 93 for WPX, 27 for CQ-DX, and 17 for WAZ. The round trip for these applications from Moscow averages 18 to 24 months. While we are on the subject, *CQ* recently raised the fee for the WAZ certificate from $1 to $2.

Apparently they will never run out of new countries. Look for the Marshall Islands, the Palau Islands, and Micronesia to obtain some form of independence by 1981.

Congratulations to WA8MOA, recent recipient of the first "Michigan DX Plaque," for his efforts in the Mellish Reef operation.

The FCC recently raided Brewer Labs in Porter, Oklahoma, and seized some 440 illegal CB linears valued at $200,000. According to a story released by the AP, these amplifiers cause TVI.

The January/February issue of *Oceans* magazine has an interesting article on Canton Island, the Auckland Islands, and Palau. Check your library for a copy.

W6KPC just put up a 12-element 20 meter beam on top of a Sky Needle at the top of a 100' tower.

The International Island DX Net meets every Friday at 0300Z on 14280 kHz. The net is operated by the Whidbey Island DX Club. Write WB7BFK for more information.

Maurice Caplan, who gave out many a new country contact as VS5MC from Brunei, has retired from the DX wars and returned to England.

KV4KV says no Desecheo activity until the ARRL decides on its country status.

Some big bets are being made among the south Florida DXers as to who will be the first to earn 5BWAZ. The winner will be entitled to use "The Big Florida Pizza" on his QSL card.

The Delta DX Association will send a computer-derived beam-heading chart to any DX station *free* for the asking. Write to Box 73, Metairie LA 70004.

Sometimes a letter to Box 88 will shake out some long-needed cards. Two years ago, K6DT wrote complaining about some overdue QSLs for contacts back in 1972. Now, two years later, the cards have finally come through. Where Box 88 is concerned, it just takes a lot of patience and sometimes a little prodding.

Word has come through that E. R. "Robbie" Robson 5Z4ERR, formerly VQ4ERR, became a silent key during December.

Chod Harris WB2CHO is in the process of setting up a permanent contest-type QTH in Montserrat, where he holds the call VP2MAY. The station setup will include a five-element quad for 10/15/20 and a two-element quad for forty. He will have three complete operating stations. Chod was with the group which ran up 7.4 megapoints from 9L1CA in the recent CQWW DX contest. In the meantime, between contests, he plans operation from VP1, PZ, 8R, TF, HB0, 3A, and other European spots. QSLs go to WA1SQB.

China recently ended their economic aid to Albania, and there seems to be a slow shifting of the Albanian axis toward the west. This opens up future possibilities of a true ZA operation by some visiting Europeans.

Don't discard your old *Callbooks*. Many of our DX friends overseas are unable to obtain US or foreign *Callbooks*. Send your old discarded *Callbooks* to WA4JQS, and Tony will mail them overseas at his expense. He will also advise you of the recipient.

The Long Island DX Association is looking for associate editors. Contact W2IYX if you are interested in helping out and getting your own byline.

Speak of the Devil, or at least a new country, SM3VE and SM4CNN advise that they have received a license and will activate ZA5A on all bands including OSCAR and 436 MHz the last week in June and first week in July.

There is really no excuse for not having worked KV4. Dick KV4A ran off nearly 50,000 QSOs during 1978. That's better than 100 a day.

The ARRL is petitioning the FCC for Novice privileges in the 220-MHz band. They have also asked for standard FM emission in the 52.0 to 52.5 MHz band.

The February *QST* carried a feature article on "incons." These are devices which combine inductance and capacitance into one component. The ARRL is issuing a news release on these and is canvassing the House and Senate Subcommittee on Communications. The feeling is that incons are helpful in reducing RFI.

TT0KP has been showing on twenty recently. He is reported to be a police officer there in Chad. QSL to F9KP.

Total US amateur licenses as of December 1, 1978, numbered 353,162. This breaks down to 61,000 Novices, 68,000 Techs, 118,000 Generals, 82,000 Advanceds, and 22,000 Extras. The gain for November was 325, and the 12-month gain was 26,404.

Contesters will be happy to note that K8TMK has filed a petition, RM-3281, asking amendment of part 97 so that contacts of one minute or less will not require an amateur station to identify the station it has contacted. This might work against the contester, since many contest-type DX stations go several minutes without identifying themselves, and the only time you hear their call is when the US station gives it.

QSL INFORMATION

6O1FG to G. D'Aurella, Via Antonio Fogazzaaro 87, 00137 Rome
7X4AN to Hermann Samson, Tannenweg 2, D-5501 Osburg, W. Germany
8P6EZ to W1RED
9L1SL/C to WA0CAE
9X5AL to SM5IB
A6XB to K1DRN
A6XJA to Box 2526, Dubai
CE0AE to WA3HUP
D68AD to G3RWU
DA2QE to Robert Chilcote, USAFSB Box 15, APO NY 09742
EA8QL to EA8QU
F6FFQ/TT8 to SP 85215-BM, France
FB8XU to F6FLZ
FB8XV to F5VU
FP0DI to VE1DI
FR7BU to F6EQN
FW8AC to F6BWX
GT5AVQ to DK5FJ
GT5CGV to DF7FH
GT5CID to DJ3BG
GT5MIR to DC1FP
H5FXT to PO Box 137, Lynden, Ontario, Canada L0R 1T0
HD0E/HD5EE to K8LJG
HH2Q CW to W4ORT, SSB to K4UTE
HL9TG to Gary Kohtala, USAFSK Box 194, APO SF 96271
HL9WE to WB8USM
HS1ABD to W1YRC
HS1WR to Box 155, Bangkok
J28AY to Marc Bourg, Ancienne Poste, Chaniers-Le-Bourg, 17610 Chaniers, France
JT1BG to I8YGZ
K1CO/PJ7 to W8AEB
KZ0DX to 225 West Coyote Drive, Carson City NV 89701
S79WHW to Box 491, Mahe
S8AAP to Box 821, Umtata
TT0KP to F9KP

Thanks for much of the preceding information goes to the *West Coast DX Bulletin*, the Long Island DX Association *Newsletter*, and *WorldRadio Magazine*.

New Products

from page 27

THE IC-280

The versatility of a microprocessor is exemplified in the Icom IC-280 4 MHz + FM mobile radio for two meters. Referred to as the "remotable" radio, the IC-280 actually comes assembled for immediate operation as one box. However, the same radio may be separated by removing the head, connecting the optional remote cable to each unit, and mounting the head in a small place where almost no other radio will mount.

"Remotability" is not the only reason to have an IC-280. The microprocessor covers all 4 MHz of the two meter band, plus some at both ends in 15- or 5-kHz steps which are selected by the user or the processor. In addition, there are three memory channels which can store any frequency which can be programmed on the dial. This allows the set to act as an "eyes-on-the-road" radio for safety. The modular 10-Watt output stage has plenty of power to drive the most popular amplifiers to full output, and the continuous display of frequency in either the transmit, receive, or memory position makes the IC-280 the best FM radio Icom has come up with yet. For further information, contact *Icom East, Inc., 3331 Towerwood Dr., Dallas TX 75234*, or *Icom West, Inc., 13256 Northrup Way, Suite 3, Bellevue WA 98005*. Reader Service number I1.

MOS- AND CMOS-SAFE INSERTION TOOL WITH PIN STRAIGHTENER

OK's new model MOS-1416 DIP insertion tool inserts both 14- and 16-pin IC packages into sockets or predrilled boards. Total conductivity reduces static electricity. A ground strap may be easily attached for highly-sensitive MOS and CMOS ICs. Durable chrome-plated ABS construction features precision parts for long life and easy one-hand operation. The tool's narrow profile permits it to work on densely spaced patterns, while its unique insertion mechanism assures accuracy as well as excellent "feel." Finally, the tool includes a remarkable pin straightener built into the handle. Simply insert the IC, rock it on the straightening saddle, and push down on the tool. An automatic ejector delivers the IC ready to be placed in the insertion end for installation in your board or socket. The MOS-1416 is available at your local electronics distributor or directly from *OK Machine and Tool Corporation, 3455 Conner Street, Bronx NY 10475*. Reader Service number O5.

HUSTLER ANNOUNCES NEW TRIBAND BEAM FIXED-STATION ANTENNA

Hustler has announced the new Model 3-TBA triband beam antenna. The amateur beam antenna covers the 10-15-20 meter bands. The longest overall element length is 23' 10", and the antenna is designed and tuned for a 24-dB front-to-back ratio. Its unique design permits the elements to be much shorter than other beams on the market today. The boom length is fourteen feet, and the antenna provides better than 8-dB gain. The 3-TBA easily handles power inputs of 1 kilowatt, and is easily matched to 50-Ohm cable.

Constructed of 100% heavy anodized aluminum with stainless steel hardware, its weight is only 36 lbs. The all-new Hi-Q trap design uses twelve-gauge aluminum wire, requires no capacitors, and, once tuned at the factory, is permanently weather-sealed for years of reliable operation. This antenna is sure to be a favorite of those operators entering DX contests.

For further information on this or other Hustler antenna products, write: Sales Department, *New-Tronics Corporation, 15800 Commerce Park Drive, Brookpark OH 44142*. Reader Service number N2.

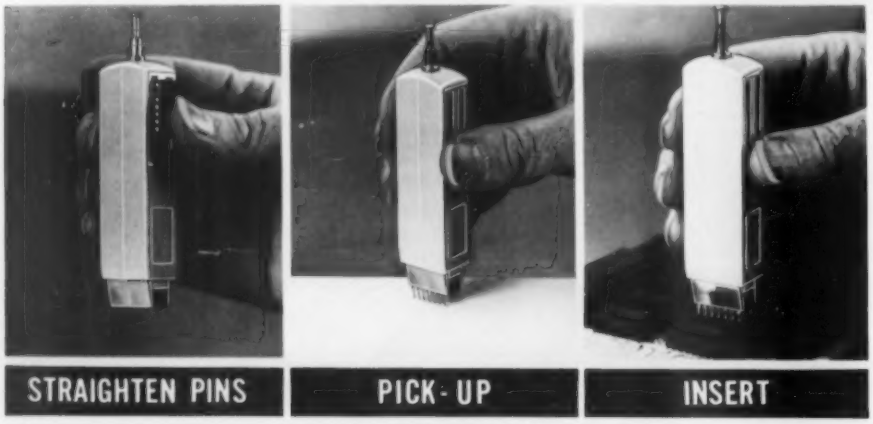
Icom's IC-280.

READERS REVIEW THE WILSON MARK II HT

Have you been looking for a small, lightweight, hand-held two meter unit? I had been looking for about a year, but could not decide which brand to buy. Then, on July 4, 1978, I heard a QSO in progress on 146.52 between John Shean N9TV and Charlie Dalton WD9AGK. John said that he had bought a Wilson Mark II and had worked Indianapolis direct with it early that morning. He had climbed his tower to work Indy, which is about 100 miles north of here. I was with my family at my parents' house. Supper was finished. It was too early to light fireworks, so I broke into John's QSO on my Tempo FMH and asked if I could come to see his Mark II. Three days later, I ordered my Mark II from John AA9B, sales manager at Spectronics. It was shipped the same day. I have bought several rigs from Spectronics, and I find them to be excellent people with whom to do business.

The Mark II is small enough to carry in your shirt pocket with about half of it sticking out. It comes with crystals for 146.52 installed in channel A. It has six channels, A through F. There are separate receive and transmit crystals for each channel. Rejection of adjacent channel signals is excellent. The receive crystals must be netted along with the transmit crystals. There is a warning in the manual to avoid high rf fields, since they may cause damage to the receiver. The Mark II should not be used in close proximity to a base station antenna or closer than twenty inches from another unit. Transmission without the antenna can cause damage to the transmitter. My 25/85 repeater is here at my house running 100 Watts out, but it hasn't hurt the HT yet. My Mark II does an admirable job in this high-rf environment. The adjacent channel rejection it has is amazing, and you must do a good job of netting the receive crystals to get full performance. The Mark II uses a small 10.8-volt nicad battery pack rated at 500 mAh. The current drain is 15 mA squelched and 100 mA at full audio output. The current drain on transmit is 500 mA with 2.5 Watts out. The Mark IV draws 800 mA with 4.0 Watts out. The manual says the battery life is 8 hours with 5% transmit, 5% receive, and 90% standby duty cycle. The battery is easily replaced. The unit is housed in a Lexan case.

Looking at the manual, the only difference I see between the Mark II and the Mark IV is the driver transistor, with the Mark IV having a higher gain driver. Both units have an MRF



OK's new insertion tool.

ALL NEW

FT-101ZD

HIGH-PERFORMANCE HF TRANSCEIVER

Today's technology, backed by a proud tradition, is yours to enjoy in the all-new FT-101ZD transceiver from YAESU. A host of new features are teamed with the FT-101 heritage to bring you a top-dollar value. See your dealer today for a "hands on" demonstration of the performance-packed FT-101ZD.

Diecast front panel, plus heavy duty case
Built-in, fully adjustable, VOX circuitry
Built-in RF speech processor for more "talk power" when you need it
Built-in, threshold adjustable, noise blanker
Equipped for SSB and CW operation. Choice of wide or narrow bandwidth for CW (with optional CW filter installed)
Continuously variable IF bandwidth: 300 Hz to 2.4 KHz
Digital plus analog frequency readout. Digital display resolution to 100 Hz
Rugged 6146B final amplifier tubes with RF negative feedback
RF and AF gain controls located on concentric shafts for operator convenience
Full band coverage: 160 through 10 meters, plus WWV/JJY (receive only)
TX, RX, or transceive frequency offset from main dial frequency
For WARAC Flexibility
Select switches for use with FV-901DM synthesized scanning VFO (option). FV-901DM provides scanners plus 40 frequency memory bank.

SPECIFICATIONS

TRANSMITTER

PA Input Power:
180 watts DC
Carrier Suppression:
Better than 40 dB
Unwanted Sideband Suppression:
Better than 40 dB @ 1000 Hz, 14 MHz
Spurious Radiation:
Better than 40 dB below rated output
Third Order Distortion Products:
Better than −31 dB
Transmitter Frequency Response:
300-2700 Hz (−6 dB)
Stability:
Less than 300 Hz in first 30 minutes after 10 min. warmup; less than 100 Hz after 30 minutes over any 30 min. period
Negative Feedback: 6 dB @ 14 MHz
Antenna Output Impedance:
50-75 ohms, unbalanced

GENERAL

Frequency Coverage:
Amateur bands from 1.8-29.9 MHz, plus WWV/JJY (receive only)
Operating Modes:
LSB, USB, CW
Power Requirements:
100/110/117/200/220/234 volts AC, 50/60 Hz; 13.5 volts DC (with optional DC-DC converter)
Power Consumption:
AC 117V: 75 VA receive (65 VA HEATER OFF) 285 VA transmit; DC 13.5V: 5.5 amps receive (1.1 amps HEATER OFF), 21 amps transmit
Size:
345 (W) × 157 (H) × 326 (D) mm
Weight:
Approximately 15 kg.

COMPATIBLE WITH FT-901DM ACCESSORIES

RECEIVER

Sensitivity:
0.25 uV for S/N 10 dB
Selectivity:
2.4 KHz at 6 dB down, 4.0 KHz at 60 dB down (1.66 shape factor); Continuously variable between 300 and 2400 Hz (−6 dB); CW (with optional CW filter installed): 600 Hz at 6 dB down, 1.2 KHz at 60 dB down (2:1 shape factor)
Image Rejection:
Better than 60 dB (160-15 meters); Better than 50 dB (10 meters)
IF Rejection:
Better than 70 dB (160, 80, 20-10 m); Better than 60 dB (40 m)
Audio Output Impedance:
4-16 ohms
Audio Output Power:
3 watts @10% THD (into 4 ohms)

arma
amateur radio manufacturers association

Price And Specifications Subject To Change Without Notice Or Obligation

YAESU
The radio.

379X

YAESU ELECTRONICS CORP., 15954 Downey Ave., Paramount, CA 90723 ● (213) 633-4007
YAESU ELECTRONICS Eastern Service Ctr., 9812 Princeton-Glendale Rd., Cincinnati, OH 45246

237 or SD 1127 output transistor. I have noticed a rise in the final amplifier temperature after several minutes of transmitting. This is normal. I have also noticed a rise in the temperature of the audio output final after several minutes at full volume, which is also to be expected. It should be possible to modify these units for switchable power output.

The accessories shown in the manual for the Mark series of HTs include a desk-type battery charger, a wall charger, a cigarette lighter-type 12 V dc charger, a speaker-mike, leather case, battery pack, and Digitran or Chomerics key pad. The Mark series uses the same kind of crystals as the other Wilson units. I put crystals from my Tempo FMH in mine with no trouble. Some of the channels I bought crystals for would not adjust to frequency properly until I changed the load capacitors to 33 pF. Caution must be used when you have the unit out of its case or else some of the small wires will come loose from the PC board. A single board houses both the transmitter and receiver, and a small auxiliary board houses some of the crystals.

The unit weighs only 16 ounces including the battery pack, and an excellent manual comes with it. It is checked out at the factory and the specifications sheet is included in the shipping box—something you don't find very often these days.

I would like to thank John AA9B for the excellent service from Spectronics, as well as N9TV for the demonstration that prompted me to buy my Mark II. Most thanks, though, go to Wilson for producing such a fine unit, the answer to my HT dreams.

How It Works

The Wilson Mark series of HTs are dual-conversion FM units with a single circuit board containing both the transmitter and receiver. An independent microphone element is installed just below the speaker. There is a connector for an external microphone. An incoming signal passes through a low-pass filter and bandpass filter to the rf amplifier, where it is amplified and passed through "selectivity elements" to the first mixer. The first oscillator uses an HC-25/U fundamental crystal with individual trimmers for netting each receive crystal. The crystal frequency is given by the equation Crystal Frequency = (Channel Frequency – 10.7)/9.

The first oscillator signal is coupled to the source lead of the first mixer, where it is mixed with the incoming rf from the rf amplifier. The output of the first mixer is tuned to the difference frequency, or 10.7 MHz. This 10.7-MHz signal goes through a monolithic crystal filter to the first i-f amplifier. "The crystal filter provides a flat-topped, extremely steep-sided selectivity curve for superior image rejection." The signal from the second oscillator running at 10.245 MHz is coupled to the second mixer, where it is heterodyned with the 10.7-MHz first i-f signal to produce the difference frequency, or 455 kHz. The 455-kHz signal goes through a ceramic filter to improve adjacent channel selectivity and spurious rejection. This 455-kHz signal is coupled through the second i-f chain which consists of four transistors followed by a limiter. The signal from the limiter is fed to the discriminator filter. The audio output of the discriminator is fed to the audio amplifiers. It has a noise-operated squelch.

The transmitter uses ten transistors and two diodes. The microphone audio is amplified, processed, and fed to the phase modulator. A deviation control is provided. Output from the oscillator is phase-modulated and multiplied in frequency by a factor of twelve. Then the signal goes through the driver to the final amplifier. The output signal is passed through a couple of filtering stages to the antenna.

Bob Miller N9RM
Louisville KY

Since I was introduced to 2 meter FM in 1968, I have wanted a Motorola HT-220 handie-talkie. Unfortunately, the price of even a used HT-220 was always out of my reach, so I made due with a variety of substitutes and eventually ended up with a battered HT-200. Now, understand that the HT-200 was a good HT in its day (1964), but it is big and heavy and limited in channel capacity (a maximum of 2). What had always attracted me to the HT-220 was its small size, light weight, and *professional* appearance.

Wilson Comes Through

Over the years, I have watched as various companies have introduced their versions of 2 meter HTs. I have found that none of them even came close to duplicating the HT-220. Sure, they had the technical performance, but they were as big as my HT-200 and just didn't look like I thought they should. Then it happened. Wilson ran their first ad for their Mark II and Mark IV mini HTs. They sure looked like an HT-220, and that price! $219.95. How could they sell it for that? Being the skeptic that I am, I figured that the ad was the typical case of marketing being a year ahead of engineering and that if Wilson ever delivered, the price would probably be up by 50%. A quick call to Wilson confirmed my suspicions. They said first delivery was in "3 to 4 months." Oh, well, I promptly forgot about it—but every month those full-page ads in *73* kept reminding me that Wilson was still there. Six months later, I began to see ads from distributors selling the Mark II and Mark IV. Surprisingly, the list price had only crept up by $10.00. In October of 1978, I saw a Mark IV at a hamfest. It really existed! What's more, it looked even better than the pictures. A long conversation with its owner revealed no problems, and apparently the unit performed as advertised. That was all it took. A few phone calls and a few days later, UPS left a package at my door. It wasn't my much-coveted HT-220, but something I think is even better —a Wilson Mark II. For a $250 package deal, I got a Wilson 2.5-Watt Mark II, nicad battery pack, rubber flex antenna, ac wall charger, and crystals for 146.52 simplex.

Overall Description

The MK II is what I would consider a *personal* portable radio. It is very small—about the size of a dollar bill and 1.8" thick—and weighs only 1 lb., even with the battery pack. It easily fits into a shirt pocket, and its appearance is really impressive. It sure is a long way from the early HTs, which looked like converted CB handie-talkies.

The case is finished in an attractive dark blue-grey textured style and apparently is pretty rugged, since mine has already survived a 5-foot drop onto a concrete floor. Inside the case is a real technical performer. Six channels are available on transmit and receive, and the performance leaves nothing to be desired. I've done extensive lab testing on my Mark II, and it easily betters Wilson's specs. On-the-air tests have been very favorable, and transmit audio quality is reported as excellent. There is plenty of receive audio, very clean with no apparent distortion. All of the controls on the top of the HT are easy to operate, and there is a HI-LO power switch on the bottom of the case. I normally leave my Mark II in the low-power position (1 Watt), since the difference in power is only noticeable in fringe areas. Low power reduces the drain on the battery by a fair amount and allows extended operating. Incidentally, the battery is a sealed, single-piece unit small enough to allow a second one to be carried in your pocket.

Receiver Description

The receiver is a double-conversion superhet with a MOSFET rf and a J-FET mixer. The first i-f is at 10.7 MHz. A 2-pole crystal filter is used for good intermod and secondary image performance. The signal is downconverted to 455 kHz, passed through a sharp ceramic filter, and then limited and detected. The discriminator uses a ceramic-type transformer and requires no alignment. The receive crystals are in the 14-MHz range and are multiplied directly to F_O – 10.7 MHz by the tuned circuits in the oscillator. Each crystal has individual trimmers for precise adjustment. The total squelched drain of the receiver is 15 mA, which allows many hours of monitoring.

The transmitter oscillator uses crystals in the 12-MHz range. Again, individual trimmers are provided to permit exact frequency adjustment. A phase modulator is used, with mike audio provided by a 2-stage amplifier. A speech clipper is used to prevent overmodulation; full modulation is obtained even when speaking a few inches away from the Mark II. Conventional transistor multipliers get the signal up to 2 meters, and a Motorola MRF 237 is used in the final stage. Incidentally, the 4-Watt Mark IV uses the same final as the Mark II. According to the schematic, the only difference in the two units is the driver transistor. The Mark II uses a 2SC741 and the Mark IV uses an MRF515. Presumably, one could replace the driver transistor, retune, and have a 4-Watt unit for less than the price differential between the Mark II and Mark IV. Maybe there is more to it than that, although I have found that 2.5 Watts is more than enough power anyway.

A solid-state T/R switch is used, and there is absolutely no noise when going from transmit to receive or back. My old HT-200 has an annoying squelch tail under the same conditions, so this characteristic of the Mark II is very welcome.

Construction

The overall construction of the Mark II is very compact, but servicing should be no problem since all the components are easily accessible. The unit is built on one single-sided PCB and uses very conventional parts—there are no custom micro circuits or even ICs. In view of this, I can't help but wonder why it took so long for anyone to develop a miniature HT. I have noticed that the

receiver and transmitter are adjacent to each other; perhaps in the past others have used more restrictive layouts to keep the two functions separated.

Accessories

In spite of its small size, there is room for installation of a touchtone pad or tone squelch option. Conventional desk- and wall-type chargers are available, along with a very attractive speaker-mike for remote operation. A leather case and 12-V car-lighter charger complete the list of accessories.

Operating and Service Manual

An excellent 22-page manual is provided with the Mark II. A detailed technical description is in the manual. Service aids include a foldout schematic, illustrated parts layout, parts list, PCB foil parts overlay, and voltage measurement chart. The manual also contains a section on isolating problems down to individual stages. If service is ever required, all the information one could want is in the operating and service manual. A 90-day parts and labor warranty comes with the Mark II.

What Do You Do With An HT, Anyway?

Like many people who have been on 2 meter FM for a while, I am way past the excitement of 100-mile HT-to-repeater contacts and have discovered that intelligent use of the HT can really enhance many situations. My wife happens to have an amateur license, and we use HTs to keep in touch when we go shopping. The Mark II is small and light enough to fit in her purse, and we can go our separate ways in shopping malls and still easily rendezvous by a quick call on the HT. It's also great for garage sales. I wait in the car listening to FM stereo, and if she spots anything interesting inside (like a KWM-2 for $50.00), I can run in and survey the merchandise. As a matter of fact, she has gotten so attached to the Mark II that I never get to use it and am back to using my old HT-200. *Wilson Electronics Corporation, PO Box 19000, Las Vegas NV 89119; (702)-739-1931.* Reader Service number W2.

Fred Studenberg W4CK
Cedar Rapids IA

Ham Help

I would like very much to use my Radio Shack TRS-80 Level II 16K microcomputer along with an interface to send and receive CW on my Yaesu FT-101E transceiver. However, to this date I have been unsuccessful in removing the bright flashes which appear on the video display when transmitting on any ham band.

One might be inclined to think that the transceiver is entirely to blame for the RFI on the video display, but I must add that the FT-101E does not cause any TVI with my home TV when it is operated in the same place as my video display or any other location in the ham shack.

The video display furnished with the TRS-80 has a "hot chassis," i.e., the chassis or internal system ground is returned to the 120-volt neutral through the power cord. Such a video display might be called an ac/dc power supply by some; the home TV has a conventional power supply. Perhaps the conventional power supply is less likely to have interference from a transmitter.

To this date, I have tried isolation transformers, power line filters, many combinations of bypass capacitors, grounding to the same ground on the FT-101E, ferrite toroid filters, and every combination of any or all of these, and none has removed the flashes on the video display.

I would like very much to hear from anyone who has solved the flashing in the video display.

John P. German W5HBH
807 South Rosemary Drive
Bryan TX 77801

The long-dormant Royal Order of Hootowls has been rechartered, and its members are again burning the midnight oil on 6 meters throughout the Southwest. I am the new custodian, and I'm attempting to contact all amateurs who were members of the original order. Original Owls may reactivate by submitting to me their name, call, mailing address, and ROHO number, along with a one-time fee of $1.00. Those who do not wish to reactivate are invited to send the information so that they may be included in the ROHO directory. A fact sheet on membership requirements is available for an SASE.

Don Abell WB5SND
6821 West Ave.
San Antonio TX 78213

I would like to modulate the Viking Adventurer transmitter for AM phone (ten meter). I would appreciate any information from anyone who has used this setup. Would an EICO 730 modulator work?

Dennis Hennigan WA1HOG
RFD 2
Pittsfield ME 04967

Can anyone assist me in obtaining a tube for an antique Westinghouse regenerative receiver, an Aeriola Sr., type RF, style 319564, made circa 1910-1920? The tube is a WD-11, Aeriotron, style 319533. The tube base is 4-prong, and has a 1½-volt filament and 22½-volt B+. The receiver is a wooden box, with a wooden chassis, rheostat, tickler, and tuning coil arrangement designed to tune 300-500 meters. I will gladly pay a reasonable price and postage for an original replacement, and welcome any advice on what to do with this nostalgic old doorstop.

Jerry Cohen WD8CJG
2568 Dysart Road
University Hts OH 44118

I am looking for an antenna which is efficient and effective, directional, and will fit in a 50 x 100 foot lot. Any designs, details, or ideas for an antenna, common or unique, would be appreciated very much.

Dennis Duckworth WB2SVR
109 Gilroy Avenue
Uniondale NY 11553

I need a manual or schematic for a "Moniscope" made by American Electronics Enterprises, Inc., of Long Beach CA.

I also need a manual and a plate transformer for a Gonset GSB-101 power amplifier. I will be happy to pay postage both ways for the manuals so that I could make copies of them.

Neil Preston WB0DQW
7024 Bales
Kansas City MO 64132

I would like to copy or purchase the manual and/or schematic for the Lafayette HE-35 six meter transceiver.

N. W. Zimmerman W7MAF
1815-17th Ave. So.
Great Falls MT 59405

I would like to put in a little request for a used model PLF 6-160 meter allband preamp (for receiver use only). I would also like to find a used 1978 U.S. *Callbook* at a reasonable price.

Paul Tremblay
8 Westfield St.
Biddeford ME 04005

I am looking for stations (including DX ones) for the International Chessplayers Net. The net meets at 2100Z, Sundays, on 14.340. No membership is required.

Rick Wentworth WB9ZJW
100 St. Mary's Blvd.
Green Bay WI 54301

I have a 2 meter power amplifier, the Amcomm 2M2. I would like to use the amplifier for SSB. Could anyone give me some information on the required modification? I have written Amcomm and gotten no results.

P. H. Schuyffel VE3JPP
8 Craggview Dr.
West Hill, Ontario
Canada M1E 4T9

I need a photocopy of an article, which appeared in the 1959 *Radio Handbook*, about a 500-Watt "deluxe" transmitter which used a 7094 in the final.

A. McGinnis WA2DTQ
55 Patton St.
Iselin NJ 08830

I would like to thank the readers who helped me out in my quest for a miniature variable capacitor for the noise bridge construction project. The letters are still coming in.

I had also requested equipment for the Pine Point Experimental School, but I am no longer affiliated with the school and there is no licensed amateur there. I regret the inconvenience caused to those readers who have tried to contact me there.

Walter Kimmel KB0CB
6033 Delafield Avenue
New York NY 10471

I have a Hallicrafters SBT 22 CW-AM-SSB transceiver. It's a military rig, fully solid-state and crystal-controlled. I need any information I can get, such as a schematic and operations manual.

Bill Mellema N3WM
13229 Old Hanover Road
Reisterstown MD 21136

I would appreciate it if anyone who has used Poly Paks' 92CU5177 and 92CU5226 (or any other circuit) to convert telephone touchtones to rotary pulses would please contact me.

Judah Schwartz KA2CES
941 45th St.
Brooklyn NY 11219

Our ham radio club desperately needs a photoelectric tube, the Cetron CE 1, or its equivalent, for an old Bell & Howell 16mm movie projector. It is no longer furnished by the projector manufacturer.

A. H. Russell WB4MAW
Tamiami Amateur Radio Club
2528 Bayshore Road
Nokomis FL 33555

I have an Avanti Moon Raker IV 11m beam, which I would like to convert to 10m. I have written to Avanti and received no results. I would like to know if anyone has converted a Moon Raker, and how I could convert mine.

Cecil R. Trail KA7ACT
Box 486
Asotin WA 99402

Social Events

MUSKEGON MI
MAR 30-31

The Muskegon Area Amateur Radio Council is sponsoring the ARRL Great Lakes Division Convention and Hamfest at the Muskegon Community College in Muskegon, Michigan, on March 30-31, 1979. This event will feature manufacturers' exhibits, technical forums, and a large swap shop. Ample parking and dining facilities are available. Friday evening at the Muskegon Ramada Inn, there will be a "Ham Hospitality" with libation courtesy of the MAARC and a Wouf Hong initiation. For additional information, contact MAARC, PO Box 691, Muskegon MI 49443, or H. Riekels WA8GVK, (616)-722-1378/9.

WORCESTER MA
MAR 31

The WPI Wireless Association will sponsor its first annual Spring Flea Market on Saturday, March 31, 1979, from 9:00 am to 4:00 pm, at the WPI campus in Worcester, Massachusetts. For more information, write WPI Wireless Association, Box 2393, Worcester Polytechnic Institute, Worcester MA 01609.

ST. LOUIS MO
MAR 31

Mayor Conway of St. Louis has proclaimed March 31st as Amateur Radio Day, and, in conjunction with this, the Gateway Amateur Radio Association is sponsoring a hamfest which promises to be a good one. Hamfest hours are 8:00 am to 6:00 pm at the H. J. Cervantes Convention Center. Scheduled events include: Wayne Green on microcomputers, an antenna forum by Hy-Gain, an FM and repeater forum by Motorola and VHF Engineering, FCC Q & A, a station-design forum by Drake, a low-cost transceiving forum by Atlas, a linear amplifier forum by ETO, a DX forum featuring the Navassa group and N9MM, a revolutionary method of learning Morse code, and an OSCAR forum. There will be special meetings for teenage hams, Ten-Ten members, Breakfast Clubbers, SWOT members, YLRL members, and others. Activities for YLs include a fashion show, a cosmetic display, and a tour of St. Louis. Talk-in on .34/.94, .37/.97, and .52. Admission is $3.00. For further information, please contact Bob Heil K9EID, PO Box 68, Marissa IL 62257, or phone (618)-295-3000.

COLUMBUS GA
MAR 31-APR 1

The Columbus Amateur Radio Club will hold its first annual hamfest from March 31-April 1, 1979, at the Columbus Municipal Auditorium, US 27 & 280, Columbus, Georgia. Donation is $1.00 at the door. There will be plenty of free parking and overnight free RV space. Exhibitors and flea market will be inside, with a free flea market outside. Talk-in on 28/88. For advance registration and details, write Bob Glasgow N4BGN, 1503 Layard Drive, Columbus GA 31907; (404)-561-7746.

PHILADELPHIA PA
APR 1

The Penn Wireless Association will hold its Tradefest '79 from 8:00 am to 4:00 pm at the National Guard Armory, Southampton Road at Roosevelt Blvd. (Rt. 1), ½ mile south of turnpike exit 28. General admission is $2.00. Setup is at 7:00 am. Sellers may rent a 6' x 8' space for $3.00; you must bring your own table. Some tables are available for $1.00, and a minimum number of power connections are available for $2.00. There will be refreshments, displays, and a rest area. Talk-in on 146.37/.97 and 146.52. For more information, contact Chuck Miller AD3X, (215)-943-3973.

PAINESVILLE OH
APR 1

The 1979 Lake County Hamfest will be held on Sunday, April 1, 1979, from 8:00 am to 4:00 pm at the Lake County Armory, 1289 Mentor Ave., Painesville, Ohio. The hamfest is all indoors. Tickets are available for a $2.00 donation. There will be refreshments, women's activities (ham and non-ham), commercial exhibits, and a 1:00 pm auction. Table rentals will be provided. Prizes include a Wilson Mark II, a Bird wattmeter, and a Drake touch-tone™ mike. Talk-in on .52/.52 and 147.81/.21. There is easy access to the hamfest via I-90 and Rte. 2.

TOWSON MD
APR 1

The Greater Baltimore Hamboree will be held on Sunday, April 1, 1979, beginning at 8:00 am, at Calvert Hall College, Goucher Blvd. and LaSalle Road, Towson, Maryland. The college is located south of Exit 28, Beltway (Interstate 695). There will be food, prizes, and a giant flea market. Admission is $3.00. There will be tables available inside the gym and the cafeteria. For information and table reservations, contact Bro. Gerald Malseed W3WVC at Calvert Hall College, 8102 LaSalle Road, Towson MD 21204, or call (301)-825-4266.

NATCHEZ MS
APR 1

The Old Natchez ARC Hamfest will be held on Sunday, April 1, 1979, at the Natchez Convention Center, Natchez, Mississippi. The event will be indoors and air-conditioned. There will be free admission and swap tables. Talk-in on 146.31/.91 and 146.52. For information, write ONARC, 1226 Magnolia Avenue, Natchez MS 39120.

WELLESLEY MA
APR 7

The Wellesley Amateur Radio Society will hold its annual auction on Saturday, April 7, 1979, beginning at 11:00 am at the Wellesley High School

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40-20-15-10 bands 2 trap — 54 ft. with 90 ft. RG58U coax - connector - Model 1001BU . . . $53.95
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Reader Service—see page 195

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cafeteria on Rich Street, Wellesley, Massachusetts. The doors will open at 10:00 am. Talk-in on .96/.36, .63/.03, .04/.64, and .52. For more information, contact Kevin P. Kelly WA1YHV, 7 Lawnwood Place, Charlestown MA 02129.

COLUMBIA MO
APR 7

The Columbia Hamfest will be held on Saturday, April 7, 1979, from 7:00 am to 4:00 pm at the Cosmo Recreation Center, Columbia, Missouri. There will be a large flea market, forums, and a buffet supper on Friday, April 6, 1979, at the Heritage House. Tickets are 4 for $5.00 in advance and $2.00 each at the door. Food and camping and hotel/motel accommodations will be available. There will be bingo and a special program for the ladies. FCC exams will be administered for Extra, Advanced, General, and Technician Class licenses. Mail completed form 610 to License Examinations, Central Missouri Radio Association, PO Box 283, Columbia MO 65201. There will be a variety of major and minor prizes including a Kenwood TS-520S and a Wilson Mark II. Talk-in on 3963 kHz, 146.16/146.76 and 223.34/224.94. For ticket information, send check or money order, plus an SASE, to John Malinak WDØAFA, PO Box 283, Columbia MO 65201.

ROCHESTER MN
APR 7

The Rochester Amateur Radio Club and the Rochester Repeater Society will hold their Rochester Area Hamfest on Saturday, April 7, 1979, at St. John's School Gymnasium, 490 W. Center St., Rochester, Minnesota. Doors will open at 8:30 am. There will be a large indoor flea market for radio and electronic items, prize raffles, refreshments, and plenty of free parking. Talk-in on 146.22/.82. For further information, contact RARC, c/o KØTS, 2514 N.W. 4th Ave., Rochester MN 55901.

ST. CLAIR SHORES MI
APR 8

The South Eastern Michigan Amateur Radio Association will hold its twenty-first annual hamfest on April 8, 1979, from 8:00 am to 3:00 pm at South Lake High School, 21900 E. Nine Mile Road at Mack Ave., St. Clair Shores, Michigan. For additional information, contact Mark C. Wilke WD8RDA, Secretary, 171 Merriweather Road, Grosse Pointe Farms MI 48236.

MADISON WI
APR 8

The Madison Area Repeater Association, Inc., will hold its seventh annual Madison Swapfest on Sunday, April 8, 1979, at the Dane County Exposition Center Forum Building in Madison, Wisconsin. Doors will open at 7:00 am for sellers and exhibitors and at 8:00 am for the public. The Forum Building has over 20,000 feet of space for exhibitors and the flea market. There will be plenty of space for parking, with overnight camping available. Hotel accommodations are also available within walking distance of the Swapfest. There will be door prizes, an all-you-can-eat pancake breakfast, and a Bar-B-Q lunch, as well as free movies throughout the day. Admission is $1.50 in advance and $2.00 at the door. Tables are $3.00 in advance and $3.50 at the door. Children twelve and under are admitted free. Talk-in on WR9ABT, 146.16/.76. For reservations or information, write M.A.R.A., PO Box 3404, Madison WI 53704.

WEYMOUTH MA
APR 21

The South Shore Repeater Association will hold its ham auction on Saturday, April 21, 1979, at Central Junior High School on Broad Street, Weymouth, Massachusetts. The doors will open and check-in starts at 9:00 am for those wishing to participate. Doors will open to the general public at 12:00 noon. The club will share 10% of the sales. Please tag all items with call and description. There will be refreshments and door prizes available. Talk-in on 147.90/.30 and .52. For more details, write South Shore Repeater Association, Town Hall Annex, 402 Essex St., Weymouth MA 02188.

KANSAS CITY MO
APR 21-22

The P.H.D. Amateur Radio Association, Inc., of Liberty, Missouri, will sponsor the tenth annual Northwest Missouri Hamfest on Saturday and Sunday, April 21-22, 1979, from 11:00 am to 5:30 pm on Saturday, and from 10:00 am to 5:00 pm on Sunday, at the Kansas City Trade Mart. The Trade Mart is located at the Kansas City Downtown Airport, with easy access to all area interstate highways, with unlimited parking adjacent to the 45,000 sq. feet of exhibition space. Display booth spaces are available at a minimal cost of $15 for a single and $25 for a double. For further information, contact L. Charles Miller WAØKUH, 7000 Northeast 120th Street, Kansas City MO 64166, (816)-781-7313.

RALEIGH NC
APR 22

The Raleigh Amateur Radio Society will hold its seventh annual hamfest on April 22, 1979, at Crabtree Valley Mall, US 70 West, Raleigh, North Carolina. General Admission is $3.00 with activities beginning at 9:00 am. There will be a covered flea market and many prizes which include a Kenwood TS-520S or Icom 211 (your choice), a kilowatt three-element tri-band beam, and a CDE rotator. FCC Amateur exams will be administered at 9:00 am sharp. Talk-in on 146.04/146.64 WR4ACF and 146.28/146.88 WR4AOE. For additional information, details, or reservations, write RARS Hamfest, PO Box 17124, Raleigh NC 27609.

NEWINGTON CT
APR 22

The Pioneer Valley Repeater Association will hold its flea market and auction on Sunday, April 22, 1979, from 10:00 am to 5:00 pm at Newington High School, Newington, Connecticut. Tables, chairs, and electricity will be provided. There will be a flea market, an auction, dealer displays and sales, planned family activities, door prizes, free parking, and food service available. For further details, contact Arnie Depascale K1NFE, PO Drawer M, Plainville CT 06062, or Evangelo Demetriou, 38 Volpe Court, New Britain CT 06053.

DIXON IL
APR 22

The Rock River Radio Club will hold its 13th annual hamfest on Sunday, April 22, 1979, at the Lee County 4-H Center, 1 mile east of the junction of Rts. 52 & 30, south of Dixon, Illinois. Advance tickets are $1.50; $2.00 at the gate. There will be indoor facilities, a camping area, free coffee and donuts from 7:30 am to 8:30 am, prizes, and breakfast and dinner available. Talk-in on 146.52 and 146.37/.97. For advance tickets, mail to RRRC Hamfest, Chuck Randall W9LDU, 1414 Ann Ave., Dixon IL 61021.

TRENTON NJ
APR 22

The Delaware Valley Radio Association and the Lawrenceville Amateur Repeater Group will hold their annual flea market on Sunday, April 22, 1979, from 8:00 am to 4:00 pm, at the New Jersey National Guard 112th Field Artillery Armory on Eggerts Crossing Road off Route 206 in Lawrence Township, Trenton, New Jersey. Advance registration is $2.00; $2.50 at the gate with tailgating $4.00 additional—bring your own table. The selling area is indoors and protected from the weather. There will be ample parking, refreshments, and restroom facilities. Talk-in on 146.52, 146.07/.67, and 147.84/.24. For further information and reservations, write D.V.R.A., PO Box 7024, West Trenton NJ 08628.

DAYTON OH
APR 27

The 10th annual FM B*A*S*H* will be held on Friday night of the Dayton Hamvention on April 27, 1979, at the Dayton Convention Center, Main at Fifth Street, Dayton, Ohio, from 8:00 pm to 12:00 pm. Admission is free to all hams and their friends. Sandwiches, snacks, and a C.O.D. bar will be available. TV personality Rob Reider WA8GFF and his group will present a floor show. There will be drawings for many prizes, including a complete Drake UV-3 with 144-, 220-, and 440-MHz synthesized modules, power supply, encoder mike, and antenna. For further information, contact the Miami Valley FM Association, PO Box 263, Dayton OH 45401.

WORCESTER MA
APR 27

The Central Massachusetts Amateur Radio Association, Inc., will hold its auction and ham flea market on April 27, 1979, at the Main South American Legion Post 341, Main Street at Webster Square, next to Atamian Motors, Worcester, Massachusetts. The doors open at 6:00 pm, with the auction beginning at 7:30 pm. At the auction, 15% of the profits will go to CMARA. The flea market tables are $5.00 (items $5 and less only). Dealers are welcome. There will be door prizes, raffles, and refreshments available. Talk-in on 146.37-146.97 and .52. For more information, contact Rene Brodeur WA1LEA, (617)-753-7480, or Dave Penttila K1COW, (617)-885-4995.

SAN JUAN PR
APR 28-29

The Radio Club de Puerto Rico will hold its annual convention and hamfest on Saturday and Sunday, April 28-29, 1979, at the Condado Holiday Inn Hotel, San Juan, Puerto Rico. For details, write GPO Box 693, San Juan PR 00936.

WILLIAMSPORT PA
APR 29

The West Branch Amateur Radio Association will hold its 15th annual Penn Central Hamfest on Sunday, April 29, 1979, from 11:00 am to 5:00 pm at the Woodward Township Fire Hall, Rt. 220 south from Williamsport. For more information, write Richard Sheasley K3QDA, RD 1, Box 454, Linden PA 17744, or call Tony at (717)-322-6017.

SHREVEPORT LA
MAY 4-5

The Shreveport Amateur

Radio Association will hold its annual hamfest on May 4-5, 1979, at the Louisiana State Fairgrounds. Pre-registration is $3.00; $4.00 at the door. This is an ARRL sanctioned hamfest.

NEENAH WI
MAY 5

The 3-F Amateur Radio Club will hold its annual swapfest on Saturday, May 5, 1979, from 8:00 am to 3:00 pm, at the Neenah Labor Temple, 157 S. Green Bay Road, Neenah, Wisconsin, just off Highway 41 at the Highway 114 or 150 exit. Facilities include a large parking area and a large indoor swap area with a free auction at the end of the day. Food and beverage will be available. Advance admission for tickets and tables is $1.50; $2.00 at the door. Talk-in on 52/52. For reservations, write to Mark Michel W9OP, 339 Naymut Street, Menasha WI 54952.

LOGANSPORT IN
MAY 6

The Cass County Amateur Radio Club will hold its second annual hamfest on Sunday, May 6, 1979, from 7:00 am to 4:00 pm at the 4-H fairgrounds, Logansport, Indiana. Go north of Logansport on Highway 25, turn right at Road 100, and follow the QSY signs. Admission is $1.50 in advance and $2.00 at the gate. Outside set up is free and undercover set up is $1.00. Bring your own tables. There will be overnight camping, refreshments, ladies' bingo, and door prizes. Talk-in on 146.52 and Logansport repeater 147.78/.18. For information, write Dave Rothermel K9DVL, RFD 4, Box 146G, Logansport IN 46947.

DEKALB IL
MAY 6

The Kishwaukee Radio Club and the DeKalb County Amateur Repeater Club will hold their 21st annual indoor/outdoor hamfest on Sunday, May 6, 1979, from 8:00 am to 3:00 pm at the Notre Dame School, 3 miles south of DeKalb between highway 23 and South 1st St. on Gurler Rd., DeKalb, Illinois. Tickets are $1.50 in advance; $2.00 at the door. Indoor tables are available or you may bring your own. The outdoor setup is free. Talk-in on 146.13/.73 and 94. For tickets and directions, send an SASE to Howard Newquist WA9TXW, PO Box 349, Sycamore IL 60178.

WARMINSTER PA
MAY 6

The Warminster Amateur Radio Club will hold its fifth annual "Ham-Mart" flea market and auction on Sunday, May 6, 1979, from 9:00 am until 4:00 pm, at the William Tennent Intermediate High School, Street Road (Route 132), two miles east of York Road (Route 263), Warminster, Bucks County, Pennsylvania. A registration fee of $1.00 per car includes one ticket for door prizes. Tailgating is $2.00 additional. Indoor tables are available for $3.00 each. Talk-in on 146.16/76 and 146.52. For further information, please write Horace Carter K3KT, 38 Hickory Lane, Doylestown PA 18901, or phone (215)-345-6816.

FRESNO CA
MAY 11-13

The 37th annual Fresno Hamfest will be held on May 11-13, 1979, at the Sheraton Inn, Clinton and Highway 99, Fresno, California. The program includes technical talks, swap tables and flea market, transmitter hunt on 2 meters (146.52), QLF contest, ARRL CD appointees meeting, ARRL-FCC forum, commercial exhibits, prizes, eyeball QSOs, prime rib banquet, and more. For full registration and eligibility for pre-registration prize, send in $17 before April 27, 1979; it's $19 and no pre-registration prize after that date. Talk-in on 146.34 /146.94. For more information, contact the Fresno Amateur Radio Club, Inc., PO Box 783, Dept. HF, Fresno CA 93712.

DEERFIELD NH
MAY 12

The Hosstraders Net will hold its 6th annual tailgate swapfest on Saturday, May 12, 1979, at the Deerfield Fairgrounds, Deerfield, New Hampshire. There will be covered buildings, in case of rain. Admission is $1.00, with no commission or percentage. Commercial dealers are welcome at the same rate. Excess revenues will benefit the Boston Burns Unit of the Shriners' Hospital for Crippled Children. Last year we donated over $1100.00. Talk-in on .52 and 146.40-147.00. For more information, send an SASE to Joe DeMaso K1RQG, Star Route, Box 56, Bucksport ME 04416, or Norm Blake WA1IVB, PO Box 32, Cornish ME 04020, or check the Hosstraders Net on Sundays at 4:00 pm on 3940 kHz.

VANCOUVER WA
MAY 12-13

The Fort Vancouver Hamfair will be held on Saturday and Sunday, May 12-13, 1979, at Clark County Fairgrounds, Vancouver, Washington. Registration is $4.00 per person which includes a drawing ticket. Tickets are also available at the door. Activities will include contests, seminars, commercial and amateur displays, family events and a large ham radio flea market. Many prizes will be awarded with the grand prize being an Icom IC-701 HF transceiver and power supply. The fairground facilities include trailer parking and ample car parking. A catered buffet dinner is scheduled for Saturday night with musical entertainment included. Price of the dinner ticket is $5.00 for adults. For registration, contact Ken Westby W7DYX, Registration Chairman, 606 Miami Court, Vancouver WA 98664.

DAYTONA BEACH FL
MAY 12-13

The Daytona Beach Amateur Radio Association, Inc., will hold its first hamfest on May 12-13, 1979, at the Holiday Inn Surfside, Daytona Beach, Florida. For Mom and the kids, there is the "drive-on" ocean beach, and shopping in the oceanside plaza. Advance registration is $3.00 per family and $3.50 at the door. For more details, contact Funfest chairman David Rusler WA4ZTT, 1725 Hope Drive, Ormond Beach FL 32074.

SALINE MI
MAY 13

The ARROW Repeater Association will hold its annual Swap and Shop on Sunday, May 13, 1979, at the Saline, Michigan, fairgrounds. Admission, including parking on the fairgrounds, is $1.50 in advance and $2.00 at the door. There will be food, prizes, and a covered area for trunk sales, as well as indoor tables. Because of Mother's Day, wives will be given free admission. Talk-in on 146.37/97, 223.18/224.78, and 448.5/443.5 MHz. For additional details, write ARROW, PO Box 1572, Ann Arbor MI 48106, or call George Raub AD8X at (313)-485-3562.

BENSENVILLE IL
MAY 19

The Radio Amateur Megacycle Society will hold its third Antenna Measuring Contest on Saturday, May 19, 1979, starting at 10:00 am on the grounds of the Flick-Reedy Corporation, corner of Thorndale and York Roads, Bensenville, Illinois. Equipment will be available to measure the gain and swr of 2 meter, 1¼ meter, and 70 cm antennas. Equipment for higher frequencies will be brought if advance request is made. Prizes will be awarded for the highest-gain antenna in each category. Refreshments will also be sold. For further details, including directions, write Joe LeKostaj WB9GOJ, 2558 N. McVicker Ave., Chicago IL 60639. Please enclose an SASE.

CADILLAC MI
MAY 19

The Wexaukee ARA will hold its 19th annual swap and shop on Saturday, May 19, 1979, from 9:00 am until 4:00 pm at the National Guard Armory, 415 Haynes Street, Cadillac, Michigan. Tickets are $2.00. There will be free parking and lunches available. Talk-in on 146.37/.97. For more information, contact Robert Bednarick WD8RZL, Publicity Director, Wexaukee ARA, Cadillac MI 49601.

DURHAM NC
MAY 19-20

The Durham F.M. Association will hold its annual Durhamfest on Saturday and Sunday, May 19-20, 1979, at the South Square Mall, Durham, North Carolina. Plenty of prizes, exhibits, and programs will be offered, and the XYLs can enjoy shopping. Ladies' bingo will be held on Sunday. Free tailgating spaces, under a covered, drive-in-and-sell flea market, come with a one-time $3.00 general registration ticket, with vendors and dealers included. Electrical power will be available. Harmonics and unlicensed XYLs are admitted free. Talk-in on 147.825-.225, 146.34-.94, 222.34-3.94. For more information, write DFMA, Box 8651, Durham NC 27707.

BIRMINGHAM AL
MAY 19-20

The Birmingham Amateur Radio Club will hold Birminghamfest '79 and the Alabama State Convention on May 19-20, 1979, at the Birmingham-Jefferson Civic Center Exhibition Hall, Birmingham, Alabama. There will be many of last year's exhibitors, including most major manufacturers and distributors. There will also be a huge indoor flea market, lots of exhibit space, meetings, forums, activities, and plenty of free parking. Plans are being made to again offer on-site FCC exams on Saturday morning. Prizes will feature at least three complete HF stations, several VHF rigs, and a home video tape recorder system. The Saturday night banquet will feature the nationally known comedian and Grand Ole Opry member Jerry Clower. Banquet tickets will be available in advance, by mail, while they last. For more information, write Birminghamfest '79, PO Box 603, Birmingham AL 35201.

WEBSTER MA
MAY 20

The Eastern Connecticut Amateur Radio Club will sponsor an electronics flea market from 9:00 am until 6:00 pm, with an auction at 1:00 pm, on May 20, 1979, at Point Breeze Restaurant, Webster, Massachusetts. It will be held rain or shine. For more information

Continued on page 156

Blake Ember W2RZJ
39 Chestnut Ridge
Saddle River NJ 07458

A Speedy Spinner Mod

— 5,000,000 Hz per minute

Knobify your rig with a minimum of effort.

After purchasing a Kenwood 820 and a Kenwood TS-700A last year, I discovered that something was missing on these two superb rigs. They needed spinner knobs so that I could QSY rapidly across the bands. So I developed a knob that can be affixed to just about any type of receiver or transceiver with a minimum of effort.

To build your own knob, refer to the labeled parts shown in Photo A.

Step 1. Place no. 2 over no. 1 and no. 3 over no. 2. Use a rivet tool or a punch on the no. 1 stem to flange it. After the stem has mushroomed, place a drop of 30-weight oil or white lube around it to ease rotation. After that, use emery paper on the base of no. 1 so that the epoxy has a good surface to adhere to.

Step 2. Epoxy no. 4 to no. 5 and let it set 10 minutes. Press no. 5 into no. 6, and then epoxy no. 7 into no. 6 and no. 8 on top of no. 6. This completes the knob.

Step 3. Take the completed top portion and lubricate the stem, no. 4 (white lube), and press it into the bottom section. The knob is now ready for mounting.

Step 4. Before mounting, make sure that both the knob surface and the rig surface are clean of oil and grease. Apply epoxy on the outer edge of the big knob and let it set for at least one hour. Then QSY rapidly across the ramps. ■

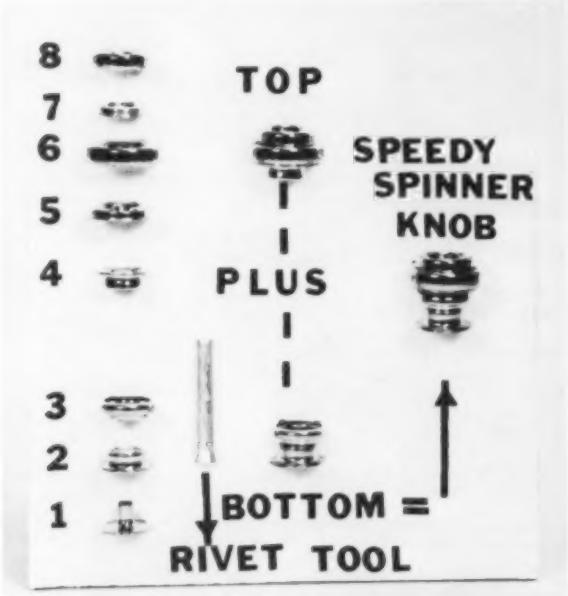

Photo A. Parts and their order for knob assembly.

Photo B. Spinner knob on the TS-700A.

Parts List

5-minute epoxy	$1.59
E Z heavy-duty snap fastener, no. 751	2.00
Prims halo buttons, 212-24 9/16"	.70
Prims halo buttons, 212-30 3/4"	.70

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NEW MFJ-962 1.5 KW Versa Tuner III

For $159.95 you can run up to 1.5 KW PEP and match everything from 1.8 thru 30 MHz: coax, balanced line, random wire. Built-in balun. SWR, dual range forward and reflected power meter. Flexible six position antenna switch. Outstanding value.

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Just ask your MFJ dealer to demonstrate these 1.5 KW Versa Tuner IIIs. Logbook quantities are limited.

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The NEW MFJ-962 1.5 KW Versa Tuner III lets you run up to 1.5 KW PEP and match any feedline continuously from 1.8 to 30 MHz: coax, balanced line or random wire.

This gives you maximum power transfer to your antenna for solid QSO's and attenuates harmonics to reduce TVI and out-of-band emission.

An accurate meter gives SWR, forward, reflected power in 2 ranges (2000 and 200 watts).

A flexible six position antenna switch lets you select 2 coax lines thru tuner or direct, or random wire and balanced line.

A new all metal, low profile cabinet gives you RFI protection, rigid construction, and sleek styling. Black finish. Black front panel has reverse lettering. 5x14x14 inches. A flip down wire stand tilts tuner for easy viewing.

Efficient, encapsulated 4:1 ferrite balun. 500 pf, 6000 volt capacitors, 12 position inductor. Ceramic rotary switch. 2% meter.

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MFJ-961 1.5 KW VERSA TUNER III has balun, six position antenna switch. Matches coax, balanced line, random wire, from 1.8 to 30 MHz.

6 position antenna switch lets you select 2 coax lines thru tuner or direct, or random wire and balanced line.

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Run 1.5 KW PEP. Match any feedline from 1.8 to 30 MHz: coax, balanced line, random wire.

Gives maximum power transfer. Harmonic attenuation reduces TVI, out of band emissions.

Black all metal cabinet. Black front panel has reverse lettering. Flip down wire stand tilts tuner. 5x14x14 inches.

Encapsulated 4:1 ferrite balun. 500 pf, 6000 volt capacitors, 12 position inductor, ceramic switches. SO-239s, ceramic feedthrus. One year limited warranty.

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M52

Reader Service—see page 195

A Variable Bandpass Active Filter

— extremely simple design

Clean up those sine waves!

Allan S. Joffe W3KBM
1005 Twining Road
Dresher PA 19025

The op amp configured to produce an "active filter" is of general interest to the present-day ham for several reasons. His activities span a greater range of technology, op amps are rather inexpensive, and the final filter is a small unit that usually does a big job in a simple manner.

The bandpass type is rather useful for voice, CW, or RTTY modes, but the usual versions suffer from the lack of a diddle pot to vary the bandwidth without substantially affecting the design center frequency.

Fig. 1 shows a familiar bandpass filter without the variable bandwidth element. Fig. 2 shows the same circuitry with adjustable bandwidth and values for a center frequency of about 800 Hz. Using 5% value components, the measured peak frequency lucked out to be 820 Hz with the variable pot turned fully clockwise. This position is the broad position of the filter. With the pot turned fully counterclockwise (the sharp position of the filter), there is a slight shift of the center frequency to 865 Hz, but to the ear this is not detectable.

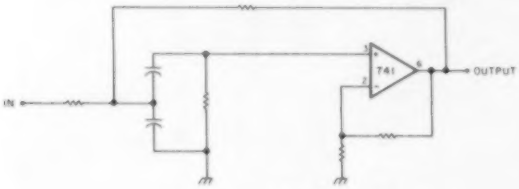


Fig. 1. Fixed bandwidth.

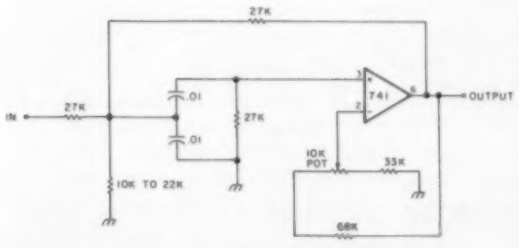


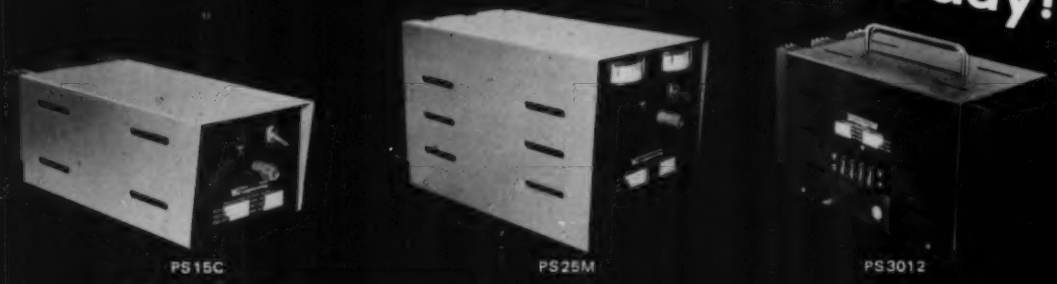
Fig. 2. Variable bandwidth.

In the broad position of the filter, the bandwidth at the 3 dB downpoints is a measured 718 Hz. The bandwidth at the 10 dB downpoints is 1890 Hz. In the sharp position, the bandwidth at the 3 dB downpoints is 275 Hz and 800 Hz at the 10 dB downpoints of the response curve. Naturally, as the pot is rotated, you can generate a series of bandwidths between these maximum and minimum limits.

With a plus and minus nine-volt supply for the 741 op amp, the available output swing is about five volts rms. There is a difference in the input sensitivity between the sharp and broad positions of the bandwidth control pot. In the sharp position, it takes about 1.2 volts in to produce the five volts out. In the broad position, this input voltage rises to about 2.7 volts.

The filter demands an input resistance of no more than 22k Ohms from the input terminal to ground, especially when the bandwidth control is set to the sharp position. If this condition is not met, the filter will oscillate, a fact that may come in handy. To illustrate, set the bandwidth pot to the maximum sharp position without any input termination. A scope on the output will show a sine wave with clipped peaks. If you slowly back off the bandwidth control, the clipped peaks will go away, leaving you with a rather nice clean sine wave that also has excellent frequency stability. The frequency of this oscillation will be close to 77% of the center frequency of the filter. ■

The best buy on the market today!



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Vhf engineering V5

DIVISION OF BROWNIAN ELECTRONICS CORP.

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Reader Service—see page 195

What About an Active Antenna?

—here's a look at one

Mixed results.

Carl C. Drumeller W5JJ
5824 NW 58 St.
Warr Acres OK 73122

What's an active antenna? Usually, it is an antenna—often much smaller than normal size—that contains an amplifier in its structure. The amplifier is intended to bring signal strength up to a level comparable to that provided by a full-size antenna.

Recently, an importer commissioned this writer to investigate the capabilities of an active antenna. It's a model YN-1000B SKYNIX Electronic Antenna. The accompanying information makes no mention of the manufacturer, or even of the nation in which it was made. This arouses a strong suspicion that it is a "bootleg" copy of a similar antenna developed in Germany about 15 years ago.

The supplied information claimed a frequency range from 150 kHz (the European long-wave band) through 108 MHz (the FM broadcast band). This range makes use of two internal amplifiers, one with 15 dB gain for all the entertainment broadcast bands, and one of 10 dB gain for the shortwave bands. The internal amplifiers operate on 12 V dc, draw 8 mA, and require a negative ground.

Armed with this information, I set up a test bench. The active antenna was mounted on a ground plane simulating a car body. Leads were run to two other antennas for comparison. One antenna was a 15-foot length of wire strung up in the same room with the active antenna, thereby putting the two under equal site limitations. The third antenna was a multiband (trap) dipole at a height of fifty feet. Provision was made for rapid shifts among the three antennas.

A general-coverage receiver, the Yaesu FRG-7, was selected for the test, and since the trap antenna would have quite good response on the amateur bands, to make a fair comparison, it was necessary to avoid checks too near amateur frequencies.

The results obtained are shown in the accompanying tabulation. (See Fig. 1.)

Frequency in kilohertz	Meter Deflection		
	Inside Antenna	Active Antenna	Outside Antenna
640	S9 + 10 dB	S9 + 20 dB	S8
940	S9 + 5	S9 + 5	S9
1560	S9	S6	S9 + 15
6150	S9	S0	S9
9000	S9 + 15	S9	S9 + 20
10,500	S9 + 15	S9	S9 + 20
11,800	S7	S0	S9 + 10
15,100	S9 + 15	S9	S9 + 10
21,500	S9 + 15	S9 + 15	S9 + 20
27,000	S9 + 20	S9 + 10	S9 + 25

Fig. 1. Tabulated results.

No attempt will be made to explain the very wide variations, as no consistent pattern was established.

It is evident, though, that the active antenna finds its best application in receiving signals in the 540-to 1650-kilohertz frequency range. It's quite impressive to see an antenna only 15¼ inches long bring in signals as well as (or even better than) an antenna twelve times as large! It's possible that it might display equal ability in the VHF-FM bc band, but I had no receiver in that range with sufficient internal shielding, or a dependable S-meter; therefore, no test was made in that range.

To sum up, this one version of an active receiving antenna should be quite acceptable for reception in the MF AM bc spectrum, tolerable in some portions of the HF spectrum, and quite unsatisfactory in other HF ranges. There are other active antennas marketed in this country and in England that may be fully satisfactory.■

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* Units with warning lights require 120 VAC, 6 W for warning light circuit.

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Frequency Range . . . . . DC to 300 MHz
VSWR . . . . . Less than 1.3:1 to 230 MHz
Power Range
. . . . 1500 watts DC intermittant. Warning light * signals maximum heat limit.
Wattmeter Ranges
. . . . . 0–15, 0–50, 0–300, 0–1500
Input Connector
. . . . . SO-239 (hermetically sealed)
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Model 334A
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VSWR . . . . . Less than 1.3:1 to 230 MHz
Power Range
. . . . 1000 watts CW intermittent. Warning light* signals maximum heat limit.
Wattmeter Ranges
. . . . . 0–10, 0–100, 0–300, 0–1000
Input Connector
. . . . . SO-239 (hermetically sealed)
Size . . . . . 4¾" x 9" x 10¼"
Shipping Weight . . . . . 12 lbs.

Model 333 Dummy Load Wattmeter

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specifications
Frequency Range . . . . . DC to 300 MHz
VSWR . . . . . Less than 1.3:1 to 230 MHz
Power Range . . . . . 250 watts intermittent
Wattmeter Ranges
. . . . . 0–10, 0–50, 0–125, 0–250
Connector SO-239
Size . . . . . 4" x 7" x 8"
Shipping Weight . . . . . 2 lbs.

Model 384 Dummy Load

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specifications
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Power Range
. . . . . 1500 watts intermittent. Warning light* signals maximum heat limit.
Connector
. . . . . SO-239 (hermetically sealed)
Size . . . . . 4¾" x 9" x 10½"
Shipping Weight . . . . . 12 lbs.

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Reader Service—see page 195

LETTERS

from page 10

ly dropped A-1. Just within the past year I decided to go for DXCC and have over 110 confirmed with 40-plus more hopefully en route.

Wish you would change the tenor of your "Never Say Die." Then I probably would drop another ham magazine in favor of 73.

John H. Pitman W1LY
Quechee VT

CARPING

I have read your magazine for a number of years and do enjoy it. However, I am disturbed at your continual carping at the ARRL, not because the ARRL does not merit considerable criticism, but because at no time have you offered us a suitable alternative.

Most organizations such as the ARRL do become inflexible and self-protective. However, challenging them directly as you do merely increases their tendency to insulation and isolation.

You have the means and, I assume, the staff necessary to develop an organization that might effectively represent the ham radio community. I can visualize an organization, not unlike the National Rifle Association, that could be a potent lobby.

Perhaps rather than indulging in ineffective criticism of the ARRL, you could invest some of your tremendous energy in the development of a real alternative organization, functioning solely in the interests of amateur radio.

Edward M. Schneider, M.D. AA6O
Woodland Hills CA

Well, Edward, you've raised some points that perhaps should be discussed. I am often asked why I don't start a second national amateur radio organization and some answers are called for.

The question can be approached better by dividing it into parts. First, why I haven't started one in the past. Second, why I don't start one now. Some of the past history has been covered in a recent editorial. Beyond that, without going into the depressing details, I can honestly say that there has been no time when I had either the money or the time needed to get something going.

That brings us up to the present. Why not get an organization started now to do all of the things which the ARRL should be doing but isn't? My feeling is this . . . since the whole future of amateur radio rests upon what frequencies we end up with after WARC this fall, and since little can be done to influence that event at this late hour, perhaps it's best to wait and see what we have left, if anything, to work on.

The organization which I have in mind would be constructed quite differently from the League. It would be based primarily on a local foundation, with very little power in the national organization. We might call it the Institute of Amateur Radio, but perhaps better would be an International Amateur Rabio Lobby (IARL). This would be more in keeping with the goals of the organization. I've belonged to several national organizations which were set up in this way and which function much better than the ARRL as a result.

I see the thrust of the IARL as being on three fronts, all of a lobbying nature. Firstly, there would be a lobby in Washington which would make the FCC aware of the rule changes which amateurs desire. This lobby would push to get these rules accepted, using pressures on the FCC and Congress for this end. I still have the concept of a yearly or semi-yearly conference of the IARL chapters where rule changes would be proposed, discussed, and voted on. This would be almost identical to the system used by the ITU.

Secondly, I see a need for a lobby on a national level. This would be on the order of "Hobby Lobby," for those of you with longer memories. This "lobby" would organize material on amateur radio for newspapers, magazines, television, radio, etc. The main purpose of this effort would be to make amateur radio known and appreciated by the whole country. It would also help interest more people in amateur radio, which wouldn't hurt.

Perhaps even more important in the long run would be international lobbying for amateur radio. This effort would introduce amateur radio into smaller countries and build up a world appreciation for the value of amateur radio. This could reflect to our advantage at future ITU meetings. An international lobby would work with the national ham groups in foreign countries to improve amateur frequency allocations in the future.

Being realistic about the cost of the three lobbying efforts, including the estimated costs of offices, experienced people, travel, telephone, newsletters, etc., we're looking at a minimum cost of $750,000 per year. That comes to about $2 per licensed U.S. ham, which certainly seems reasonable. But by the time you take into consideration the 50% of the hams who are resistant to paying for such a service plus the costs of collecting the needed funds, issuing membership cards, keeping records, sending invoices, statements, etc., you're looking at more like $10 per amateur. It's a formidable administrative job.

Most of us have come to equate the service of a national organization with observable benefits such as contests and certificates. I suspect that the IARL would have to run a full set of contests just to establish visibility. While I personally am a contest fan, you may have noticed that I've kept 73 pretty much out of the contest business, feeling that we have enough contests already. Would the IARL have to run VHF contests, a national contest, an international contest, and perhaps a satellite contest?

Let's see, what else does the ARRL do besides run contests and publish? I think that about covers it. If the ARRL runs contests, lobbies on three levels, and publishes, it should be a viable organization.

There are some serious questions that need answering. For instance, do you prefer a membership which is tied inflexibly to a subscription to the magazine? Keeping separate records is a lot more expensive than doing both together, so a combination IARL membership and subscription to 73 would be cheaper. On the other hand, there might be some amateurs who would prefer not to support an organization devoted to promoting amateur radio and yet would want to read the magazine. Let me know what you think of that.

Another question is one of officers. Would you prefer to have a national election which would select the president of the Lobby, or would you like to go with the ARRL system where the directors select the president and manager? The ARRL system is quite parallel to that in the Soviet Union where the Politburo elects the president and party chairman.

It is tempting to set up a new organization with controls which would make it either difficult or impossible for someone to lose control. This was the system that Hiram Percy Maxim used when he set up the ARRL. The problem with that system was that it resulted in a good deal of infighting and politics within the League as people struggled for control . . . a control that was almost impossible to upset. I'd prefer to avoid this pitfall. What's your thought on this?

For that matter, are there any clubs which feel that the idea of setting up lobbies on three levels is good enough for them to align with? They would thus become a local chapter of the IARL, should such an organization be desirable.

I admit that I should have come up with this plan years ago and should have organized my business and personal life so as to implement it . . . but I didn't. So, if it turns out not to be too late for such an idea, are you with it or against it? And how about that $10? That's consistent with what other national organizations charge, by the way.

Please advise.—Wayne.

NO WINNERS?

After having read your editorial in the December issue, "Never Say Die" seemed to me to be an inappropriate title. Your comments on WARC read as if Wayne Green as well as the ARRL have given up on amateur radio. Statements like "Having been an avid ham for some 40 years, I'll sure hate to lose it. It's been a big part of my life . . ." tend to put "gloom and doom" in capital letters. So if you insist on using "Never Say Die," at least make it mean something—especially now. Make those 40 years of experience count. You're in a position to do so.

Since, like yourself, no one has asked for my opinion, I too feel free to comment. Just as an amateur station is more than a collection of radio gear, so ham radio itself is more than just a hobby. How much more is a matter of record and, in spite of what we as individuals feel concerning the League, it maintains a large file on ham radio as a public service. Hams may not be unknown to the general public, but they're not a household word, either. If ham radio is on the way out, the American public deserves to know what it's losing. That in-

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cludes RACES, MARS, and *73 Magazine*. Now is as good a time as any to take an objective look at the whole amateur scene. We can't do it—we're too prejudiced. Someone has to pull ham radio out from under its rock and put it in the spotlight for a few minutes. If the amateur service goes, then commercial and military frequencies may not be sacrosanct either, and Americans may need more than the Citizens Radio Service can offer sometime in the near future.

The WARC '79 conference has been getting about as much national publicity as my last birthday. Ditto amateur radio. The time has come to reach into the dustbin of public service and use it for all it's worth. I propose a network television documentary on the whole shootin' match, written on a level of quality approaching that of *National Geographic*, fully researched, and with films and interviews of those who have been involved on both ends. Let's cover ham radio right from the beginning. If it's on its way down, it might as well go down swinging.

A project of this magnitude takes time, a lot of research, a lot of leg work, a lot of convincing, a lot of good old-fashioned salesmanship, and a lot of bucks. Most of us don't qualify in any of the above areas. Maybe Wayne Green does. Does 40 years of experience agree with my proposal or not?

Nobody has to convince a ham on the value of his hobby—convince the ones who have never heard of it. Amateur radio needs, and perhaps even deserves, national support. But if voter turnout is any indication of American apathy, then we need a lot more than a few local newspaper articles once in a while. All of us seem to require a constant reminder of our past, our present, and our future. My proposal is just a shot in the arm.

If amateur radio is no solution to third-world problems, then neither is its demise. If the African nations get the frequencies they want, can they use them as efficiently as others could? Will it take years for them to implement systems which we already have? I suspect that this latest conference in Geneva may well come out with no winners.

Lee Hughes WA2VPH
Moravia NY

SUCH IS LIFE

Having decided to try my hand at color film and print processing, and seeking a means of working a "good" timer into the budget, I dug out the July '76 issue of *73* with the W1HCI story, "Dependable Timer—for darkroom, repeater, etc." In the same issue is Al Plavcan's schematic for the low priced frequency counter, and this, of course, invited grafting parts of his schematic to that of the timer to give not only a programmable timer but also a straight 0-99 second timer for monitoring the time in the various solutions with digital readout.

I am busily hunting sources, prices, etc., for the few chips needed and expect to wind up with a precise unit at a cost far below that asked for a "normal" darkroom timer.

This prompts me to suggest that you cast about among your many contacts to see if you could stir up a circuit for a home-brew color analyst circuit. The prices asked for such as these are beyond the affordable range of the casual photo nut, and I just bet that a reliable circuit could be put together by a brother ham!

What is needed most sorely is a means of determining the subtractive filtration needed to accommodate the color negative, taking into account the particular characteristics of the print paper. This latter information is printed on each package of paper, at least by Eastman, and surely by all of the others.

I sincerely appreciate the inclusion of "other than radio" items; this is what makes *73* my favorite source.

All of my issues are carefully maintained, readily accessible, and I need not tell *you* how valuable they are as a constant source of reference.

My ham subscriptions are now limited to just two. I finally dropped the old traditional one, for two reasons: 1. Greater mileage obtained from the other two in the amount of usable material. 2. I grew to resent the rather lofty attitude assumed on the few occasions wherein I wrote to ask for clarification of a few technical points.

Apparently I had "sinned" some years earlier when I took occasion to express my thoughts about the seeming lack of proper support for the efforts of Ted Cohen and his "TV/Hi-Fi Task Force." I felt that if there was *any* specific area wherein the League should show real leadership in the way of aggressive action, this was it. Ted went about the problem extremely realistically and scientifically and laid the foundation for easing one of the most urgent problems of these times, the matter of improperly designed and constructed solid-state entertainment equipment which invited interference from the cleanest of transmitters.

I waited to indulge in color TV until I could find a set which would be both deaf and blind to my Swan 500. A local dealer was kind enough to let me test a few major brands at my home with my transceiver running normal input on 80 through 10 meters on CW, phone, and slow scan. Each TV was 100% solid state. I found that of them all, at that time, three years ago, only the Sony stood up to the test, even though the TV was separated from the transceiver by only 12 feet and was only about five feet from the base of the 4BTV antenna. On the basis of these tests, I bought the Sony color TV, and the Hi-Fi AM/FM stereo 8-track. To this date there has never been the slightest trace of pickup from my ham rig on either of the units in any of their functions.

I sorely wish my neighbors all owned Sony. I get into one of the highest advertised brands even when they have the power plug pulled from the receptacle! Naturally, they cannot be convinced that the fault lies in their own apparatus. Such is life.

Lee Clough W5GQV
Waco TX

SAM HARRIS

No, Sam Harris wasn't born with a beard. He grew it in 1944 when he was employed by Brush Development Co. (sometimes called Brush Bedevilment Co.) on Perkins Avenue in Cleveland, Ohio.

My former wife, Mary, who worked in the same department on the third floor, told me that he trimmed it with tin snips. At the time, I worked on the first floor.

I understand that Sam's real name was East, and that he acquired the name Harris from the family who raised him. From his call letters, he was probably first licensed in 1939.

About the end of WWII, Sam bought a duplex house at 1311-1313 Lakeland Avenue in Lakewood, Ohio. Mary (W8SBB 1938-58, K4UBT 1958-66) and I visited Sam at his home in the 1311 side about Thanksgiving, 1946. Sam was deeply involved with two meters at the time, using mostly military surplus SCR 522 equipment. Also, Helen had bought him a National NC 2-40-C, a low-band receiver he used mostly as an i-f with the SCR 522 receivers as front ends.

Sam's shack was a finished attic room I had used as a playroom as a small boy twenty years before. I had moved from that house when I was 7½ years of age. A playmate of that time, Buss Rhoades, who lived in the 1313 side, also later became a ham, if my information is correct.

In the later forties, I lost contact with Sam except for chance meetings at hamfests. By that time, he had moved to Burton, Ohio, and became well known on seventy-five.

It appears that I lost contact with Sam about the time that Wayne became well acquainted with him.

James B. Bamberg K4UBF
Charlotte NC

THE TAY NET

I would like to inform you of a new net made up specifically of operators 19 years old and younger. It's called the TAY Net, which stands for Teen and Younger Net.

The net control is myself, KA0AQZ. The net meets on 28.635 at 2300 UTC every Tuesday. An informal bit of ragchewing usually can be had a half hour before the net on the same frequency.

My age, by the way, is 13 years, and my QTH is Independence MO.

Please, no OM check-ins, unless you have something of interest to our age group. All hams and children of hams are invited to join in the conversation, provided you are 19 or less or have something of interest to that age group.

I would very much appreciate it if you would print this info to increase the activity. *Thank you.*

Brin Moffet KA0AQZ
Independence MO

KISS

The dc-to-dc converter described in "Try a Little KISS," January, 1979, is not as reliable as described. The converter shown in Fig. 1, page 59, would put 12 volts at terminals C-D if any of several components fail:

1. If the zener fails open, it will let R1 saturate Q1 and the output voltage at C-D will be about 12 volts.
2. If R1 shorts, the zener will probably blow before a 10- or 15-Ampere car fuse. Again, 12 volts will appear at C-D.
3. A collector-to-emitter short on Q1 directly applies 12 volts to C-D.

Possible explanations for the reporter test results (" . . . the output voltage will rise a few tenths of a volt . . . ") are: a) Terminals A-B were connected to the 12-volt source with very small wire which provided current limiting; or b) the 12-volt source was soft and did not provide a constant 12 volts

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input. Was the input voltage at A-B monitored during the tests?

An electronic "crowbar," i.e., an SCR across C-D, could be added to the circuit to short-circuit C-D in the event the voltage at C-D exceeds the desired output. To prevent damage to the converter, a properly-sized fuse should be inserted in series between A and the transistor, or between the emitter of Q1 and the crowbar. Such a crowbar could be used with a simple zener-resistor regulator.

No circuit is completely component-failproof! Use high-quality conservatively-rated components in any critical application.

J. T. Hancock WB8DRF
Jackson MI

VHF ENGINEERING

I would like everyone to be aware of the fine service one of your advertisers, VHF Engineering, is providing.

I have an old HT 144-B which died. After a prolonged attempt to fix it myself (with expert help), I gave up and sent it to VHF Engineering. They returned it in roughly 2 weeks, several days *before* Christmas. They didn't just fix the unit, however. They gave me a replacement piece of hardware which I had lost, and they also replaced all of the point-to-point wiring (the HT 144-B was a kit), making it look much more professional. All of this was done for the fixed nominal labor fee alone. The parts were supplied free.

I think that this kind of exceptional service should not go unnoticed.

David Rabin WB9PSD
Wilmette IL

NOW HEAR THIS!

As one of many, I have fallen for the attraction of CW machinery. My particular unit is a PET with the excellent attachment Microtronics makes.

While I work many stations on CW, I of course prefer to work other "CW machines" when using this unit, as the copy is then 100% just like the printed page. Hand-sent CW is, as a rule, 85-95% readable if the sender is using an electronic bug and down to 15-25% readable if the sender is hand-pumping with considerable swing. A typical bug error would be "6E" instead of "the" on the screen caused by improper spacing between the "t" and the "h". If it happens once, you can plan on "6Es" all through the QSO because this is that particular operator's habit! In any case, I strongly recommend systems like this; it is really fun and in my case has totally rekindled CW interest.

The reason I am writing is to suggest that a particular frequency be used as a worldwide and preferably bandwide CW-machine calling frequency. If we could settle for some kind of reasonable standard, perhaps we could more easily get together. If speed is kept to a reasonable digit, non-machine-users could hear what we are saying. Thus I suggest the following frequency: XX.069 (for XX, insert 14, 3.5 or whatever). For initial speed, I suggest 20 wpm. This would provide studious code-learners with a readily available standard code speed to practice on, and it's slow enough that it is copied easily enough by ear. .069 is an easy number to remember, for various reasons, and doesn't appear to be any net frequency or the like. Please advise if you know differently.

Now hear this, all you machinists out there: The frequency is XX.069 and the speed is twenty. CU on ur favorite band!

Ken C. Barroll W7OP
Seattle WA

A BELIEVER

I just got home from school and found my copy of *73* had arrived today. As usual, an excellent magazine! I was reading your editorial and have a few comments on the part on page 190, "What about the code?" At first, when I saw your constant advertising for your code tapes throughout your editorial, I thought that was a little uncalled for. But then I began to think. On Monday of this week (Jan. 8), I went and passed my General after upgrading from Technician. Over the summer, I purchased an ARRL code kit with two tapes and all that. I also had one of your 13 wpm tapes. I listened to the ARRL tape, then yours. I thought that I would use the ARRL tape since it was easier to copy. Every once in a while I'd put your tape in the recorder just to try it, but I always gave up. I went to the exam, then it hit me like a hammer: Your tapes are the ones to use. They are sent at the FCC standard and the ARRL tapes are spaced at about 10 wpm. Luckily, I passed, but it would have been a hell of a lot easier if I had stuck with your tapes! It may just be me, but I think the percentage of failures would be about half of what they are now if tapes offered for practice were like yours! I'm a believer! I am a student in high school (10th grade) and have little time to mess with studying for ham exams with school exams to worry about. I think that I could have upgraded with less practice and worry with your tapes.

Keith Arnold N8AQR
Columbus OH

CONGRATS

I made it through my Extra the second time I took it. I feel I can honestly say that your study guide for this class license was a major factor for my success. Even if one is not interested in getting the Extra, the book makes an excellent reference source. I've always been a poor student, but this book was fun and the learning process painless! I find that now I understand the material as opposed to merely knowing facts and information.

Congratulations on a masterpiece! There were places where I felt you were prolix and/or pedantic, but, on the whole, this book should be hailed as a classic of the study guide genre.

Thank you for helping me achieve my license.

Bob Wanderer WB2MCB
Pompton Lakes NJ

PEANUT BUTTER

Just a note to compliment you on your fine magazines, *73* and *Kilobaud*. I know they must be good because the first postal employee who handles them must tear open the wrappers and all the others down the line must read them during lunch or coffee breaks. So far I have not found peanut butter between the pages, but the way the pages look, I would not be surprised. Too bad you cannot entice these people into their own personal subscriptions! I am sure the problem is not unique to me, and if others save the issues as I do, we appreciate good copies for the bookshelf.

One last note on *Kilobaud*. For years I have been throwing away those super 1st time subscription offers only to finally knuckle under last month to a trial copy. What a super computer magazine! If I could afford it, I would purchase all your back issues of *Kilobaud*.

Keep it up—you've got the only magazines on the market with so much content it takes a month to read.

Roger Syvertsen K0VOD
Brainerd MN

COMM SPEC

I am writing to let you know that one of the advertisers in *73 Magazine*, namely Communications Specialists, is a fantastic firm to do business with.

When I had a problem with an ME-3, I shipped it back to them on a Monday. The following Monday, a repaired unit was waiting for me when I arrived home. Two months later, a different problem arose; again it was shipped back to them with a letter explaining what was wrong. One week later, a brand new ME-3 arrived with a notation that it was replaced under the warrantee. There was *no* hassle or lengthy correspondence.

Organizations such as theirs and *73 Magazine*, who is particular about the advertising that is accepted, deserve all of the praise that can be given to them. Communications Specialists and *73 Magazine* rate very highly on my list. I have been a subscriber of *73* since you published your fourth issue.

Julius Countess K2VYD
Smithtown NY

73

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see page 188

Ham Help

I need a service manual or schematic for a Polarad model KS-5799-L2 video monitor.

A. Kaiser
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I have heard much about the R-391 receiver by Collins. I am not a ham but an SW DXer moving up. I am looking for performance specs, capability, schematic, etc. I would like to know where they are available. I haven't seen it advertised at all. In Germany they're hard to find!

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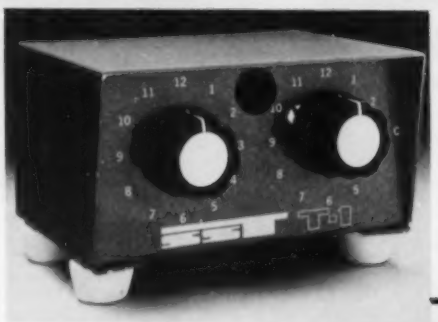

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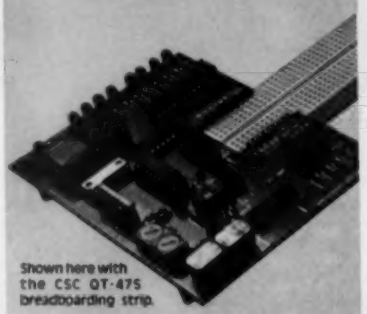

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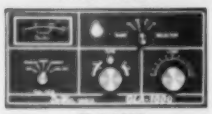
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Reader Service—see page 195

Lew Fitch W4VRV
109 Robin St.
Clemson SC 29631

Help for the Hearing-Impaired

— don't miss another phone call!

See the light?

Note: Telephone company regulations vary regarding attachment of external devices to telephone lines. You should check with your local telephone company offices before using the equipment described in this article.—Ed.

A hearing-impaired member of my family couldn't hear the telephone in some rooms of the house. Sometimes, when I called home, the phone wasn't answered even though I knew that someone was in the house. The major problem turned out to be that the bell was not clearly audible in the room that was used extensively for reading and sometimes for TV. A solution that was acceptable to all was to flash a light when the phone rang. In this case we chose to turn off the circuit that the reading light, hi-fi, and TV were on. It also incidentally turns off the vacuum cleaner in that room, and nobody could hear the phone when that was running. The circuit for the device is shown in Fig. 1.

This device was constructed in one evening out of spare parts as follows: an old power transformer was selected for T, and the high-voltage winding is used for the phone line side. Since the ring frequency is around 25 Hz on most systems, this winding should be rated at a minimum of 200 V ac. The 115-volt winding is then used as the secondary of the transformer. (An audio plate-to-grid transformer could be used the same way if you're old enough to have one of those in the junk box.) An audio generator was then hooked to the high-voltage winding through the capacitor C, and several values were tried to get a maximum 25-Hz voltage across the secondary. In my case, 1.3 uF did the trick, but this value will be different for every transformer.

Relay A is a sensitive dc reed relay that was removed from a computer board. A 12-volt 5k-Ohm relay should work well, but the higher the resistance of the coil, the less load it will put on the ring voltage. Resistor R also serves to raise this impedance, and also helps filter the dc produced by the diode. I would suggest starting with about 2.7k Ohms for R. I used an oscilloscope across a 100-Ohm resistor to measure the current drawn from the line at 25 Hz, and the ratio of voltage to current for my version of the circuit came to 10,000 Ohms. That should be light enough loading not to upset the telephone company. The capacitor keeps you from drawing any dc current.

The contacts on the sensitive relay, A, should not be used to interrupt much current, so it is shown switching a 115 V ac power relay that actually handles the heavy current. I installed the circuit in a box adjacent to the circuit breaker box, and ran two small-gauge wires to the nearest telephone line junction. Now when the phone rings, most of the circuits in the living room go off with each ring and it is not possible for anyone in the room to be unaware of the ringing. The freedom of movement granted to a deaf person expecting a call is well worth the minor inconvenience of occasionally having the lights flash for a few seconds.■

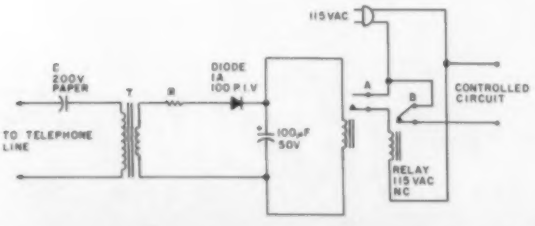

Fig. 1. See text for procedure for finding C, T, R, and A.

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Reader Service—see page 195

Try a Bi-Loop Antenna

—gets you coming and going

Two loops are better than one.

W. W. Davey W7CJB
Rt. 1, Box 121
Charlo MT 59824

This antenna design has performed as well as a 3-element beam on 144 MHz and better than a 2-element full-size yagi on 14 MHz. The idea for this design came from the antenna described by ZF1MA in the December, 1976, issue of *73*. The bi-loop configuration needs to be more or less exact to get the best performance.

Having used single loops in the past and noted their ability to reduce man-made noise, I decided to try for more gain—and still keep the closed loop design. My first experiment was on 144 MHz. It took me a whole ten minutes to nail some 3/4" x 3/4" sticks together and tack a test antenna in place. The antenna was compared with a 3-element yagi on the Lookout Pass repeater, 80 miles distant. The Clegg FM-28 S-meter readings were slightly higher with the bi-loop. Results were repeatable, so it was decided to try the 14-MHz configuration between a couple of poles. In nearly all cases, there was an improvement in signal strength of 1 to 2 S-units over my full-size 2-element yagi. With some signals coming from high angles, there was no difference in signal strength. With low-angle DX signals, though, there was a definite improvement over the yagi. The polarization was vertical.

The normal impedance of a single loop is slightly over 100 Ohms, so when two such loops are fed in parallel, the impedance comes close to a good match for 70- or 52-Ohm cable. This impedance will vary slightly with the height above ground.

As mentioned above, the loops need to be adjusted to an almost-perfect square for best performance. When the extreme ends of the loops were stretched out in a diamond shape to raise the bottom of the loop higher above ground, the low-angle gain fell off in comparison with the yagi.

The lower corner of each loop is only 6 feet off the ground and is kept in place through the use of a one-pound weight which just touches the ground when the loop is taut. Raising the entire array should further improve its performance.

This antenna is simple to build and performs well in two directions. There are deep nulls in the plane of the loops. The maximum radiation is broadside to the wire. Each loop is made up of 73 feet of #14 enameled wire, which makes each side of the loop 18'3". Use lightweight ceramic or plastic insulators and depend on nylon rope for additional insulation. The insulator which terminates the coaxial feedline is shown in detail in Fig. 1.■

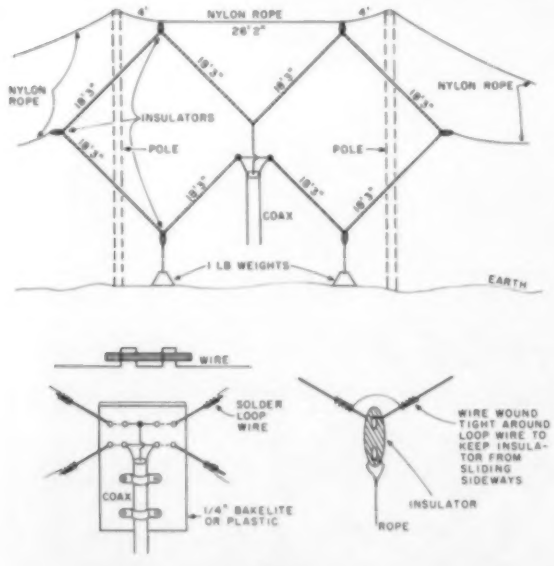

Fig. 1.

14.00 MHz	1.2:1
14.05 MHz	1.1:1
14.10 MHz	1.0:1
14.15 MHz	1.1:1
14.20 MHz	1.1:1
14.25 MHz	1.2:1
14.30 MHz	1.25:1
14.35 MHz	1.3:1

Table 1. Swr readings for the bi-loop antenna. Readings on 7 MHz and 21 MHz were high (at least 7:1), but from 28.0 MHz to 29.0 MHz, the swr was almost constant at 1.8:1.

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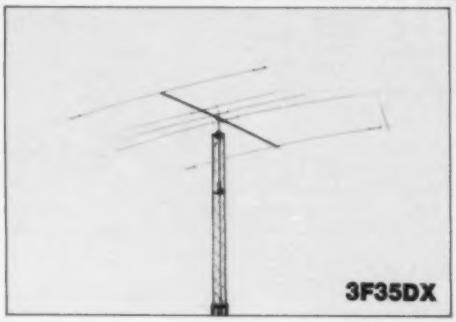
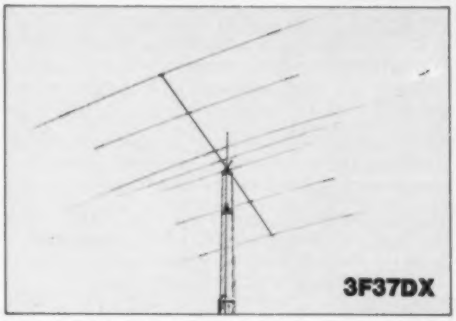
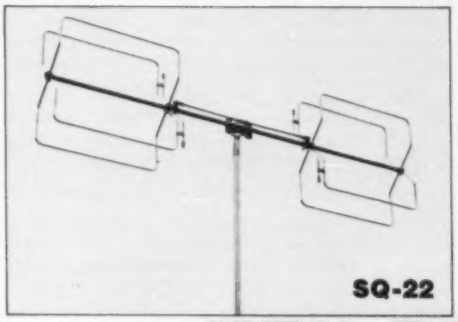


3F35DX



3F37DX

MODEL		3F37DX	3F35DX
BAND		14 21 28	14 21 28
ELEMENTS		7	5
ELEMENTS PER BAND	20m	3	3
	15m	5	3
	10m	5	3
ANTENNA GAIN	20m	8.5dB	8.0dB
	15m	10dB	8.5dB
	10m	10dB	8.0dB
FRONT BACK RATIO		25dB	20-25dB
MAX. POWER INPUT		3kw	3kw
VSWR		1.5以下	1.5以下
IMPEDANCE		50Ω	50Ω
MAX. ELEMENT L.		10.5m	10.5m
BOOM LENGTH		7.5m	5.0m
BOOM DIAMETER		50mm	50mm
TURNING RADIUS		5.3m	5.25m
WIND RATING		40m/sec.	40m/sec.
SUITABLE MAST		50mm	50mm
WEIGHT		23kg	17kg



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Reader Service—see page 195

Simple RTTY IDer

—uses five ICs

Automatic operation at the press of a switch.

Paul J. Tew G3MEJ
1-B Morton Road
Morden, Surrey
England SM4 6EF

To provide identification on RTTY without the use of keys or mics, this circuit was used for automatic operation at the press of a switch. It provides a matrix of 80 bits. With a Morse dot = 1 bit, dash = 3, letter space = 3, and word space = 5, it allows for DE and most 5 letter calls, i.e., DE G3MEJ. The DE could be omitted to give sufficient space for longer calls or, alternatively, other ICs could be used to give a matrix of, say, 128, 160, or 256 bits.

A momentary push of the ID button sets the flip-flop and enables the counters, IC1 and IC2. The BCD output of the first counter, IC1, is decoded by the 7442 and the message is selected, via the diodes, by the 74151 and output on IC4, pin 6. Complementary output is available on pin 5. At the end of the count sequence, IC2, pin 11 goes high and resets the f-f ready for the next push.

The clock, IC5A, while perfectly satisfactory, needs careful setting up. A socket for IC5 is recommended. Select a value for R1 (say 1k-4k) while tweaking RV1 to obtain oscillation at pin 6. Then adjust the value of the 100-uF capacitor to give the frequency required. RV1 allows only for a stable start and operation of the clock and is not intended as a frequency adjustment. If the output level at pin 6 is too low, change the IC! Even those of the same make and batch give different results—hence the socket. An alternative clock using a 555 or 7413 might be preferable, but this all makes the PCB larger. Values shown gave a frequency of 10 Hz and a Morse dot length of 100 ms. This is long enough to stop a mechanical printer doing its nut at 45 baud. Note that the reading of CW via two tones may need brain adjustment if you are used to single tone CW. Allow for this before assuming the circuit is not functioning correctly.

Read the matrix as a page, starting at the top left-hand corner and ending at the lower right-hand corner. The diodes can be anything in the junk box, preferably germanium, but silicon also work (1N914, etc.). Note on the matrix that there is a space at both ends of the "message," so that whichever tone is being keyed, there is a break before or after the ID. Otherwise, the first/last ID bit would merely blend into the steady tone state. A PROM could have been used instead of the diode matrix, but they cost real money against peanuts for the diodes.

A convenient PC board size, without getting cramped, is 3 x 4 inches. The output transistor, VT1, should be suitably rated for your own keying arrangements. ■

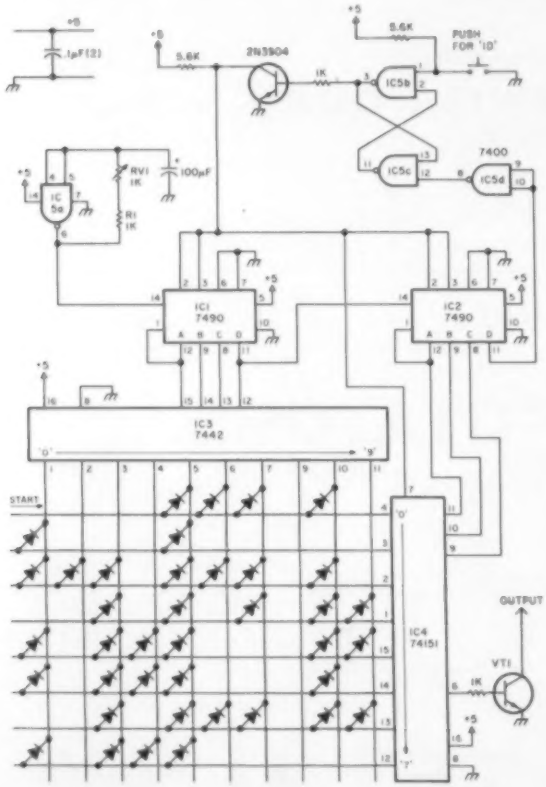

Fig. 1. CW IDer.

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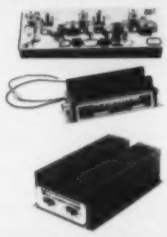

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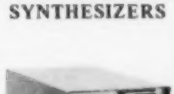

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Tales of Speech Processing

—including a practical design

Tolerating the screamers and whisperers.

Thomas C. Harper WA4JHS
11109 Carmon Street
Riverview FL 33569

Conversation overheard on 20 meter band, SSB:

"Old man, I'd like you to give me a report—I want to switch in my processor and see what it sounds like. . ."

"OK, switch it on. You're about 5 and 9 now."

"★^{4}#"&^{4}#★^{1}&2&?"

". . . Ah. . . Yeah. . . Ah. . . Sounds pretty good. . . Really brought my S-meter up. But I think I missed the question . . . Try me again."

Anyone who works even a little SSB regularly has heard that conversation, usually many times. At the same time, we are all familiar with the low duty cycle characteristics of human speech. This attribute of speech has led to many schemes, some wilder than others, but all aiming to improve information transfer by speech. And listening on the bands tells one that some of the more elaborate designs can sound as awful as some of the more rinky-dink ones.

A short history of speech processing is probably in order. The basic character of speech has been known since at least the advent of the oscilloscope; and in the old AM days, several transmitters (Heath/Johnson/others) incorporated speech clipping followed by a suitable filter. The reason for the filter was obvious: when the top is lopped off a signal, harmonics are generated, increasing the modulation bandwidth and causing a fuzzy sound in the recovered audio. Some of these clipper/filters were very simple and straightforward and some of them sounded very good, with a tremendous improvement in intelligibility; some of them sounded awful.

Then SSB came along, and at first it sounded awful enough to the AMers without complicating the whole thing with speech clipping/processing. In fact, in the great SSB vs. DSB controversy of the 1950s, reported in the proceedings of the IRE and other journals, it was alleged that one of the problems of the then "new" SSB was that it didn't lend itself to simple speech processing. This attitude persisted for many years, even though some unreconstructed mavericks were using speech clippers of one kind or another on SSB, and they could see a difference on the plate current meter. Some of them neglected to mention to their contacts that they were using clippers. Possibly there were some guilt feelings, especially after hearing conversations such as the one above.

A hairy mathematical proof made the rounds and found its way into the *Handbook* (ARRL). It demonstrated to everyone who had been through first year trig that clipping at audio for SSB was wrong-headed and possibly dangerous. It had terms like $Sin^{n}X$, where n was between zero and one. Oh, it was wonderful! Mathematicians rejoiced at the elegance of it.

There appeared to be one unwarranted assumption, however, and that was that the operator would attempt to modulate an SSB transmitter with these (nearly) square-topped waveforms. And as the argument proved, you can't reproduce square waves directly using

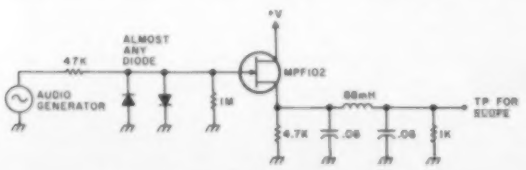

Fig. 1. Demonstration clipper/filter.

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SSB. Neglected was the fact that most operators would have used a filter after the clipper which would have rounded the sharp square edges by removing the harmonic energy.

Most of us are aware of the fact that a square wave is composed of a fundamental frequency and a whole drove (infinite number) of harmonics. Some have waded through the Fourier series analysis, and some can see it intuitively. But if you have never seen it on a scope—even if you have been through Fourier analysis frontward and rearward—you should hook up a simple clipper, followed by a sharp filter that cuts off just above the frequency you are clipping. See Fig. 1 for a sample hookup.

Try this circuit; it is very dramatic. It also serves to illustrate one of the problems with audio speech clipping. The clipped waveform is cleaned up, that is, restored to a single frequency, only if the filter cutoff is relatively close to the frequency being clipped. For instance, if you clip a 200 Hz sine wave, and pass it through a 2 kHz filter, the nice sine wave does not come back. What you get is a mess; now the waveform is still sharp-edged but is usually tilted as well, due to the phase shifts through the filter.

And since the filter for an audio speech system cannot cut off before about 2000 Hz, there is an irreducible problem. Do not despair, however, there is a compromise solution which is well worthwhile. It is possible to have an audio clipper which does not sound bad.

Why do so many sound bad? One reason is obvious. The operator can't stop turning the level knob soon enough—depending on other stations to set

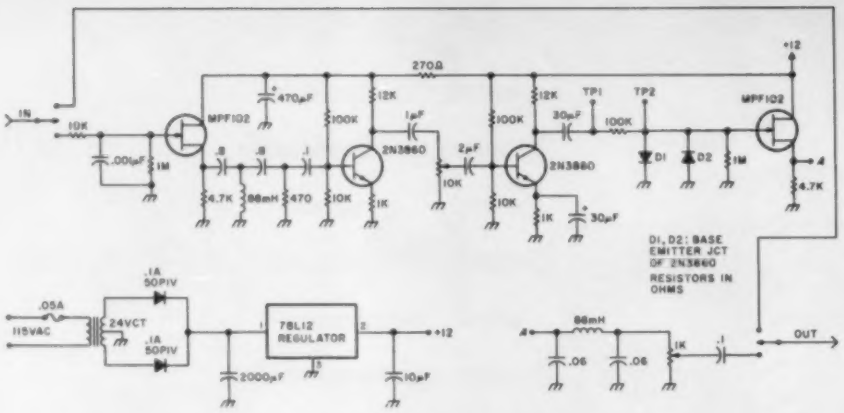

Fig. 2. Audio filter/clipper/filter.

clipping levels is haphazard at best.

Some indication can be obtained, however. You know you have gone too far when signals are 10 over 9, you are hearing no QRN/QRM and the other operator keeps asking you to repeat what you said. Many clippers, especially home brew ones, suffer from rf pickup. Rf pickup can destroy an otherwise good clipper. In addition to these problems, the low frequency phase shift/tilt problem is often heard. And finally, some operators using transmitters with sweep tube finals have discovered the tubes were not able to stand the increased duty cycle.

In spite of these caveats, clippers, as well as other forms of speech processing, are becoming more common now. The new all-transistor rigs are as comfortable with 100% duty cycle as they are with 30%, and the FCC has started to meddle with linear amplifiers.

And—are you ready?—The *Handbook* (ARRL) has a graph on page 392 (Figs. 13-20) in the 1977 edition showing 15 dB of audio clipping improves the signal-to-noise ratio by nearly 4 dB. Now you wouldn't build a linear amplifier for a four dB gain, unless you were a CBer, or instructed to by the FCC, but with an audio clipper you can get 4 dB for peanuts. Four dB, just lying around waiting for you to pick it up, like loose change, like found money.

Another goody, but not quite as satisfying as found money, is the text in the 1977 *Handbook* (ARRL) on clipping, clippers, and related subjects. A rather elaborate processor is detailed. It is good to read about, even if you don't build it; in the 60s we called stuff like that mind-expanding.

But enough of that; let's build a clipper. It ought to be simple. It ought to be cheap so some money will be left to build something else. But it ought to sound good. The filter/clipper/filter in Fig. 2 satisfies these objectives.

Looking back to address the problems listed above:

1. Rf. The 10k resistor and the .001 capacitor form a low-pass filter which keeps out rf. The 10k resistor could be replaced with a 1 or 2 mH choke, but the 10k resistor is cheaper, and adequate.

2. Low-frequency square waves and tilt. This problem is addressed by using low-frequency rolloff. All frequencies below 500 Hz can be greatly attenuated or even eliminated. The first MPF 102 source-follower feeds a T-section high-pass filter which attenuates the low frequencies, before clipping.

3. Tweaky fingers, or Oops! My plates just melted. The prototype has no knobs on the outside. Knobs on the outside are OK, if you can restrain yourself. Otherwise, you are better off to set it and forget it. Use a scope.

Additional notes: TP1 and TP2 are used with a scope to initially set the clipper. You can set it for whatever clipping level you want, up to the power supply voltage limitations. Eight volts p-p at TP1 sounds good. D1 and D2 are silicon junctions, so the level at TP2 will always be about 1.2 volts p-p. However, it is interesting to look at this point anyway.

The second MPF 102 source-follower feeds the low-pass filter. Output level is set with the 1k pot. A DPDT switch is included for those people who feel insecure if they can't do a regular comparison with distant operators.

My filter is used maritime mobile, and I find it a lot easier to carry around than a linear amplifier. It is very handy when running phone patches for the crew; I can tolerate the screamers and the whisperers—without external knobs. It's not as effective as a 2 kW linear amplifier, but it's a lot easier to pack into my suitcase.■

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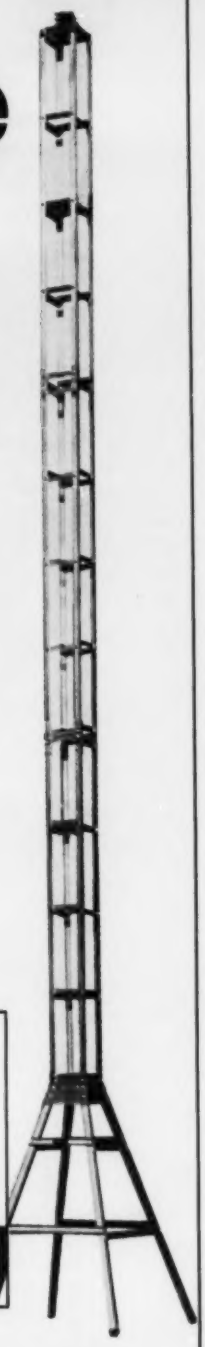

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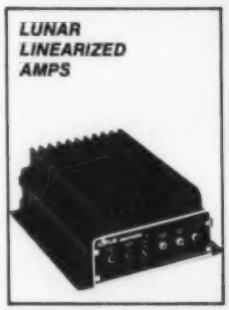

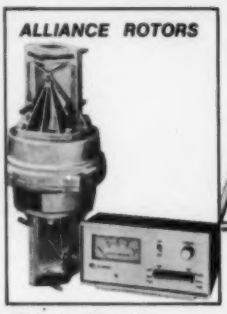

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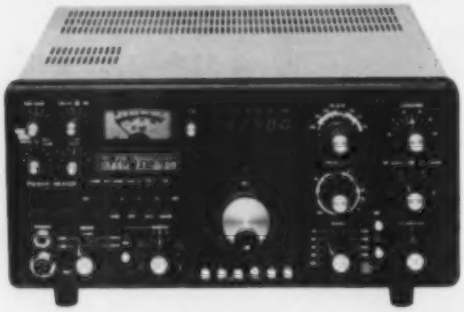

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PTT for Ten-Tec's Linear

— no more "aahhh" and "uuhhh"

Step-by-step instructions.

Anton M. Giroux DA1NF/WD6AXL
HHT, 2d ACR, Sig0
APO NY 09093

Often, during a QSO, one can hear the distant operator begin each transmission with "Aahhh" or "Uuhhh" or some such. There can be three different reasons for this characteristic:

a. The guy really doesn't know what to say.

b. He is using a maladjusted VOX.

c. He is using a Ten-Tec Model 405 linear amplifier.

The first two problems fall under the heading of

Front view showing modification switch.

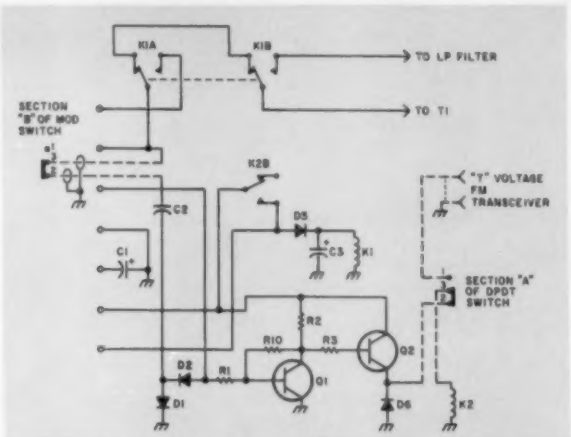


Fig. 1. Schematic of COR circuit showing modification for PTT switch. Leads from B section of DPDT switch are miniature 50-Ohm coax with shield grounded at switch end only.

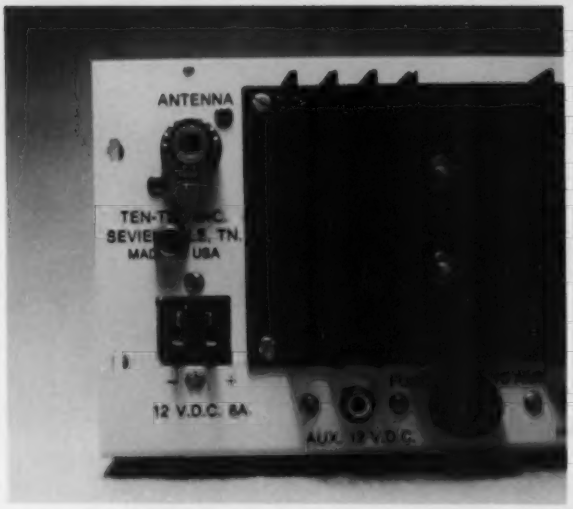
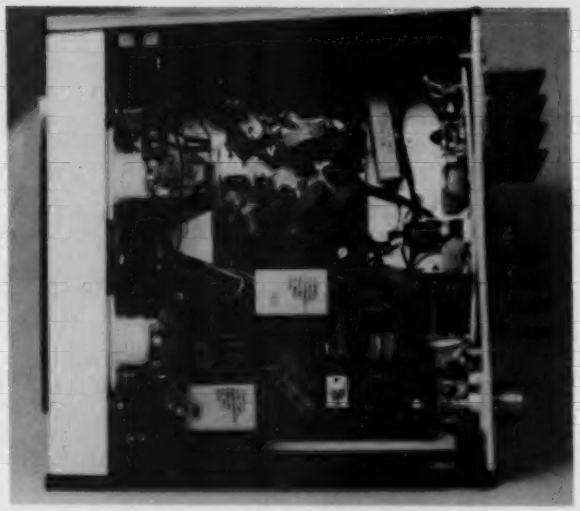


Fig. 2. The location of phono jack.



Bird's-eye view showing location of control board.

"operator headspace" and can only be corrected by personal endeavor. The third problem was mine, and involves a slight deficiency in an otherwise outstanding solid-state rf amplifier by Ten-Tec.

The linear is keyed by an rf-actuated transistor switch which controls two relays—sort of an AM COR. The main problem is that the mechanical action of the relays is just too slow. If one doesn't say "Ahh" or "Uhh" to begin the transmission, the first word and a half will be lost to relay action. My first thought was to replace the relays with quicker reed-type relays. However, I didn't have any, and they proved to be rather expensive. I finally decided on PTT and was pleasantly surprised to find that this only involved the addition of a DPDT slide switch and a phono jack.

The switching circuit is on the rf-changeover board (#80163). The theory of operation is simple. See Fig. 1. Rf from the exciter (the book claims ¼ Watt is needed) is rectified and used to activate Q1 and Q2. When Q2 is activated, it allows current to flow through the coil of K2. When K2 is energized, it allows bias voltage to flow to the PA and energizes K1, the antenna changeover relay.

To make the modification, just follow these simple steps:

a. Drill a hole in the back of the cabinet just large enough for a phono jack. See Fig. 2. I placed mine between the B+ connector and the rf-output connector.

b. Where the switch is put is really up to the individual. Some folks don't like to mess up the face of their equipment, but I had a miniature DPDT slide switch which fits nicely beside the T/R Delay potentiometer. If the switch is put in the front, the mounting plate, located behind the front panel, will have to be cut away to fit. See Fig. 3.

c. Locate the rf changeover board. This board has the two relays and is located behind the swr meter. Remove the rf changeover board from the amplifier by extracting the two screws holding it to the terminal strips and gently prying it loose with a screwdriver. Locate C2 on the board (see Fig. 4) and unsolder the lead connected to the foil trace leading from the rf-input pin to K1A. Leave the other end of the capacitor soldered to the circuit.

d. Strip the shielding back from two pieces of miniature rf cable (RG-178 or equivalent) about seven inches long. Clip the shielding completely away from one end of the cables and connect the shielding of both cables together at the other end. The ends of the cables with the shielding completely removed are connected to the circuit board. One center lead is soldered into the hole left by the lifted lead of the capacitor (C2) and the other is soldered to the lifted lead of the capacitor.

e. Turn the board to the foil side and locate the foil trace which is the junction of the Q2 emitter, D6, and K2 coil. See Fig. 5. Using a sharp knife or file, scrape away the foil between the D6 solder point and the K2 solder point. Two pieces of #22 stranded wire were used for the connection at this point. One wire was soldered to the K2 side of the break and the other wire soldered to the D6 side of the break.

f. Replace the board in the terminal strips. Make sure that the pins don't get bent in the process and make sure that the board isn't in backwards. K2 is supposed to be located right behind the swr meter. Also, do not forget the piece of cardboard which shields the circuit board from the chassis.

g. Wiring the switch. See Fig. 6. The coax center lead, which is soldered to C2's lifted lead, is soldered to the wiper of section B. The other center lead is soldered to pole 2 of section B. The shielding is grounded at the ground point for the lamp behind the swr meter. The wire which is soldered to the K2 side of the foil break is soldered to the wiper of section A of the switch. The wire which is connected to the D6 side of the break is soldered to pole 2 of section A. When the switch is in this position, the COR circuit operates normally and PTT is disabled. Connect a piece of #22 stranded wire to pole 1 of section A, and run it along the cabinet to the center connection of the phono jack. Leave pole 1 of section B open. When the switch is in this position, the COR is disabled and the linear will operate PTT from an external voltage

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Fig. 3. The location of slide switch.

source.

Speaking of the external voltage source to energize K2, where do we find it? If you are using the Argonaut, Model 509, the answer is easy—from the accessory jack on the back of the 509. Pin 2 of the accessory jack accesses a little rascal called "T Voltage," which exists only when the transceiver is in the transmit mode. The voltage produced is only 9.3 V dc, but I found that adequate to energize the relay, and it doesn't seem to strain the exciter. Users of the Argonaut, Model 505, the "PM" series CW transceivers, or other QRP rigs will have to do some more modifying. For the Argonaut, 505, and the "PM" series rigs, an additional reed relay was installed between the mike PTT and ground with the contacts between B+ and a phono jack added to the rear of the set.

As I wrote this up, I realized that there are many other ways to provide PTT to the amplifier or to install quicker relays. However, the parts for this mod came from a junk box, so it was the cheapest way to go.

The main thing is to completely isolate the COR circuit when operating PTT. I had originally isolated K2 from the rest of the circuit, but the COR still takes ¼ Watt to operate. That's a 10% reduction in power at 2¼ Watts input from the exciter.

For the past year I haven't sounded like I didn't know what to say, nor have I received complaints about a maladjusted VOX. The circuit works great and when SSB starts to drop out, it is easy to switch back to the COR for some CW work. ■

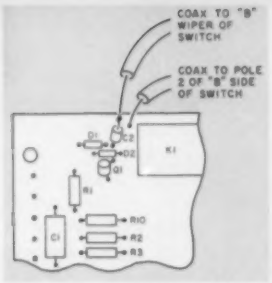

Fig. 4. Corner of top side of control board showing location of C2 and coax cable connections.

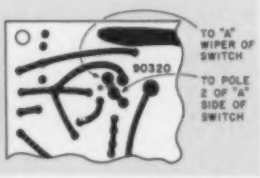

Fig. 5. Corner of foil side of control board showing location of foil trace requiring break and wiring for section A side of DPDT switch.

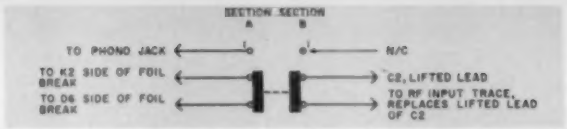
SECTION A
SECTION B
TO PHONO JACK
N/C
TO K2 SIDE OF FOIL BREAK
C2, LIFTED LEAD
TO D6 SIDE OF FOIL BREAK
TO RF INPUT TRACE, REPLACES LIFTED LEAD OF C2

Fig. 6. The wiring of DPDT switch, placed in the T/R position.

Reader Service—see page 195

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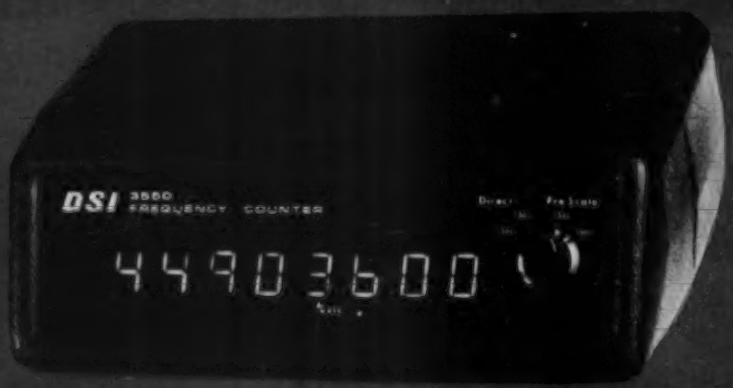

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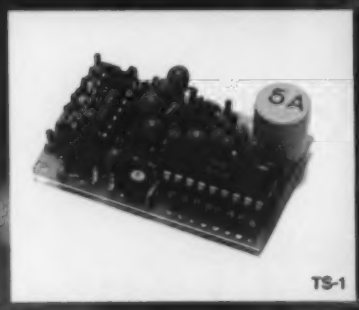
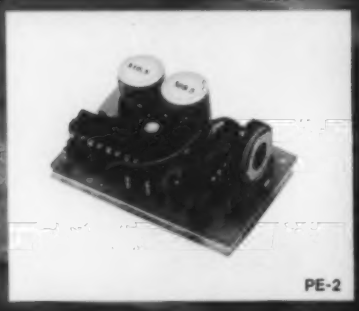
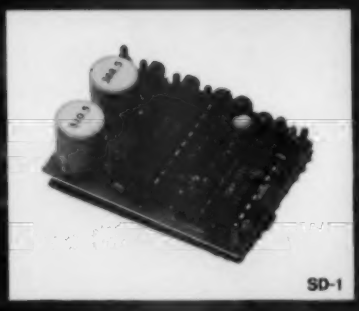


TS-1

TS-1JR


PE-2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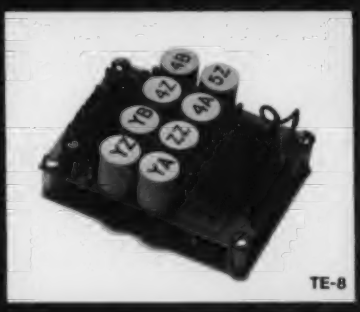
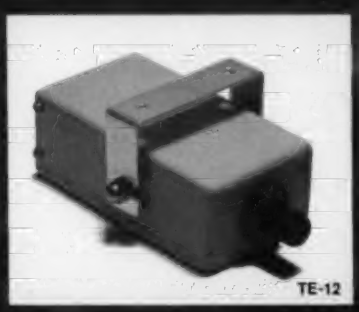
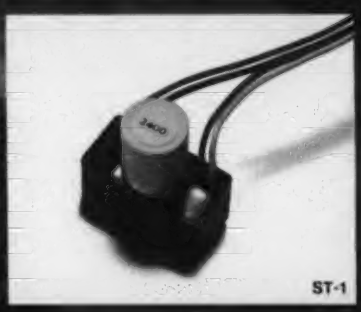


TE-8


TE-12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Disaster Preparedness

—it can happen here

Are you ready for a real emergency?

By the second day after the earthquake that devastated most of the cities in Guatemala, it was easy to know where the victims were buried: The smell of decomposing bodies guided the rescue workers. Removing the debris and taking out the corpses was a very painful and grueling job.

Back in Miami, after three days covering the disaster for the *Miami Herald*, I still had the stench deep in my nostrils. As I was looking at the prints coming out of the dryer, memory of the smell gave an added dimension to my thoughts. For a few seconds I believed I was still there, and in my ears I heard the voice of the little girl who sat in the dirt near the field hospital, crying, "Where is Mama? Where is Mama?"

When you are in this kind of situation, you are unable to believe that it could happen in your country, your city, your community . . .

But you are dead wrong, old man . . . This *can* happen to you and to your town, any time, any second. Are you prepared to cope with such a situation?

You are a ham radio operator, and your duty in disaster circumstances is to establish communications in the shortest period of time. That is what amateur radio is all about. We have a responsibility, and we must act accordingly.

Check Equipment

After you read this article, go into your shack and take inventory of your equipment. Then go to the main power switch (yes, the one in the rectangular gray box!) and turn the power off. Back in the shack, find out if you can call a fellow ham in Washington DC and tell him that there was an atomic explosion close to your town and the power plant evaporated with all the personnel inside.

I am not talking about war. An accident can happen. Not long ago, a Russian satellite, with an atomic plant in its guts, landed in northern Canada. Fortunately, the plant did not explode.

On a minor scale, electric power can be knocked out by a tornado, hurricane, earthquake—take your pick of many possibilities. The chance of an emergency is real, and you could be in the middle of it.

Emergency Power

After you find out that you can't establish communications without commercial power, it is time to find another remedy. A small portable electric generator could be the answer. Storage batteries are a cheaper solution and may be more reliable and safe. With a good 12 V dc power supply, you can operate the 2 meter rig to get in contact with local ham radio operators and get organized. With the same battery supply, you can go

airborne in the HF bands, if you are fortunate enough to own a solid-state rig. Long-distance communications are a must in an emergency.

There are a few all-solid-state little rigs for HF on the market, covering ten to eighty meters. Some, like the new Atlas 350-XL, go all the way to 160 meters, with listening capabilities in the WWV frequencies. Ten-Tec also makes a nice all-solid-state little rig, and jumping on the bandwagon are Drake, DenTron, and Alda. The Alda 103 is a three-band rig with battleship construction, capable of taking a lot of punishment.

Of all the rigs, I like Atlas best. Do not make the mistake of believing that the new 350-XL is a deluxe version of the popular 220-X. The 350-XL is a completely different transceiver, with many sophisticated improvements.

But let's stop talking about transceivers and get back to our hypothetical emergency situation with your lack of power.

A gas power plant costs money, and not everybody is ready to invest a lot of dough on something that will be standing by doing nothing but smell. I believe that one or two storage batteries, with 50 or more Ampere-hours, can provide power for a single sideband operation on two meters for the critical early hours after a disaster strikes.

Because storage batteries emit corrosive fumes, it is not wise to keep them indoors. Put them in a wooden box, vented on the sides, sitting on a stand, in the backyard, protected with plastic tiles. Perhaps you could use solar cells to keep them charged. I'll leave that part up to your imagination.

Mobile Equipment

Having mobile transceivers in the car for the HF and VHF bands is an ideal backup for the base station. Actually, the first news relayed to the world of the earthquake that leveled the city of Managua, Nicaragua, was sent by a ham radio operator from his mobile rig. (Enrique Gabuardi YN1EGL). After he and his family escaped from their crumbling home, he went airborne on 20 meters and contacted Adrian Espinosa YN1AEO/W4 in Miami. With tremors of fear in his voice, he told him of the disaster they were witnessing. Espinosa called Rafael Estevez WA4ZZG on the land line. Estevez was the president of SIRA (International Society of Ham Radio Operators).

Gabuardi's faint signal from Managua, from a mobile station, sparked the chain reaction that was translated into a gigantic rescue movement staged by the US Government, the Red Cross, and local and national ham radio organizations. Together with doctors, medicines, food, and clothes, two meter rigs and a group of volunteer Miami radio operators were flown to Managua to help the Nicaraguan hams in the establishment of emergency traffic.

A wounded man is helped by a friend. Thousands lost families, homes, and were injured.

An emergency situation could mean that you, yourself, are forced to leave your home and be relocated in a safe area. In a case like that, you should report

A little girl looks over the rubble which was her home. She does not know where her family may be.

This woman faces a grim future, with her home destroyed and her husband dead.

to the authorities that you are a licensed ham radio operator and can assist with communications. This could facilitate your transportation with your equipment and power source. This is one reason why I emphasize the importance of small solid-state rigs. (Another is that in flood conditions electrical equipment is dangerous, and low-voltage rigs like all-solid-state are safer.)

Disaster Training

Field Days are traditional among amateur radio operators. Every year, clubs and radio organizations all over the country get airborne and compete. But is this the real kind of training we need?

During the last ten years, I have been covering, as a newspaperman, revolutions and major disasters in the Caribbean and Central America. In my trips, I made contact with the local radio amateurs. These experiences taught me that while Field Day operations are a lot of fun, they are not remotely close to conditions one finds in a real situation. Technical skill to establish communications is not enough if you are not adequately prepared.

Preparedness and coordination within local ham clubs and Civil Defense organizations are very important. If you belong to a club which sponsors a repeater, be sure that the technicians in charge have that repeater backed up by storage batteries in case of power failure.

Hurricane and tornado warning notes are important. A well-organized system can save many lives. Mobile operation is a must and if you can work all the bands from your car, that will put you in a favorable position to help your fellow citizens. Another point: Don't risk your own life unnecessarily! You are more useful alive and in one piece.

Be Ready Yourself

Finally, provide for your own basic needs. Water contamination and food shortages must be anticipated. Water purifying tablets like Halazone should be on hand. Nonperishable foods, cereal, canned beef, milk, and sugar should be stored at all times for yourself and your family.

First aid articles like cotton, bandages, aspirin, iodine, alcohol, and other standard items should be stored in a box for easy access and transportation. Good first aid kits can be purchased at any drug store.

Take your immunization shots regularly and keep your certificate on hand. This will give you clearance with the authorities to move around with freedom. It is a good idea to take courses in first aid and rescue operations with the local Red Cross. Try to stay in good physical shape. Remember that a good pair of legs can save your life when everything collapses around you.

Good luck, and 73! ■

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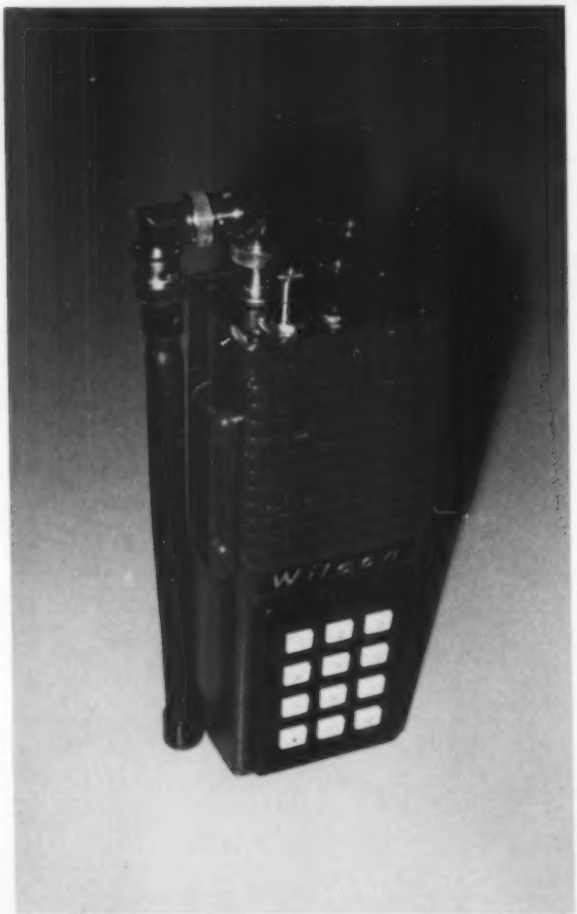

Lewis Dickson WA4HUZ
1814 Hidden Glen Dr.
Marietta GA 30067

Recently I became the proud owner of one of Wilson's latest innovations, the Mark II. This new hand-held is quite compact, light, and easy to carry.

I have included a couple of features on my rig I feel make it more versatile and easy to handle.

First, I have added a belt clip to the back of the unit. The best clip I have found is by Motorola. It matches the color and texture of the plastic of the Wilson case exactly. The only way I have been able to get this clip is by ordering the complete back with clip for the HT220 from Motorola. It is part number NLN6675A and costs $9.63. (It has the big Motorola "M" on it, but just look at it as a "W" upside down.)

Installation is easy—just drill two small holes near the top of the battery cover and attach the clip with two screws.

Second, I made an addition at the antenna. When carrying hand-held rigs that are restricted to rubber ducky antennas on your belt, the ducky tends to get stuck under your armpit. To avoid this uncomfortable experience, I added two 90° BNC connectors. This allows the rubber ducky to be swiveled down alongside the rig out of the way. Granted, this is not the most ideal position for such a high gain antenna for DX work, but it's good around a hamfest to monitor for your buddies to call and even to transmit short distances or listen to nearby repeaters. When you need to work DX, just swivel the antenna into the up position.

I took my modified Mark II to the Atlanta hamfest and was stopped several times by people inquiring about the antenna arrangement. When I returned to the hamfest the next day, I noticed half a dozen people with "bent" rubber duckies on their Wilsons.■

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An 8080 Repeater Control System

—part III: software

The finishing touches.

A development system is necessary to write and debug a program of the size and complexity of that of the repeater control. There are commercial development systems available, and hams lucky enough to have access to these systems have the opportunity to modify the program presented here with ease. Medium-to-large-size hobby computers are also equal to the task. I used my personal homemade computer for development. It has 60K of read/write memory, a high level operating system including a text editor and assembler, printer, debugging tools, and the capability to program 2708s. The processor itself is an 8080, so I was able to actually execute the repeater program on it before burning it into ROM.

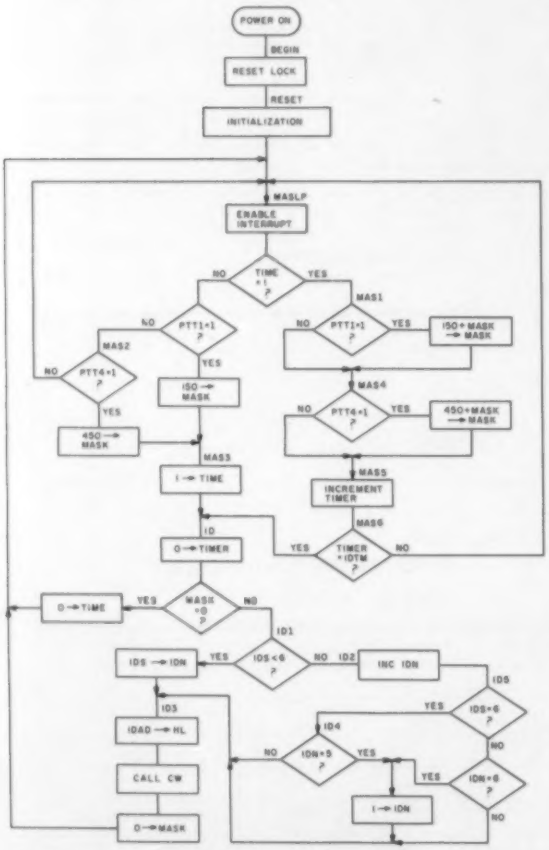

Fig. 1. Foreground program.

A good development system is a must when starting from scratch, but if the program is to be used as presented with only code changes, most any hobby computer can be made to program the ROMs. Major modifications would necessitate reassembly.

Program Analysis

The repeater control program is fairly long and it may appear quite complicated at first glance. Everything is broken down into manageable subroutines, so it is not too difficult to follow program flow. The software consists of two programs: the foreground program and the interrupt program. The two programs are separate and operate independently. The foreground program counts time, and when it is time for an identification, it performs the CW ID. Touchtones™ interrupt the processor, and control is passed to the interrupt program (which performs whatever task is required). The foreground program may be interrupted at any time, and when the interrupt service routine exits, control returns to the foreground program at the point where it left. This is apparent when listening to the repeater. If the repeater is identifying, and a touchtone is sent, the ID halts, and, after the tones are handled, the ID resumes where it left off. The beauty of the scheme is that the interaction of the programs is handled entirely by the interrupt hardware.

Foreground Program

Refer to the program listing. At the beginning, some labels are defined. The various ports are set equal to the proper values. CWSPD sets the speed of the CW. At its present setting, the speed is 19 wpm. The CW speed should be proportional to CWSPD. IDTM0 through IDTM3 set the time duration between successive IDs. This is currently set at three minutes.

When the 8080 is reset, it begins executing com-

mands at address 0. Refer to Fig. 1, a flowchart of the foreground program. At BEGIN, a lock is cleared. The lock permits the removal of the ability to enter the control mode. This will be explained in detail later. Control passes to RESET, where all variables are initialized. All of the output ports are zeroed. A note is in order about how the program handles output. The 8080 can output to its output ports, but it cannot read its output ports back in. Since we need the ability to be able to change only one bit at a time in the output ports, a memory byte is reserved for each output port. Every time the processor outputs data, it writes the output information in the locations OUT0M through OUT7M for ports 0 through 7. This way, if an output bit needs to be changed, the corresponding memory location can be read, the one bit changed, and the byte output. All bits of port 7 are set, because the row and column inputs to the touchtone generator are active low. The stack pointer is loaded, and control jumps around the interrupt location to MASLP.

At MASLP (master loop) the interrupt is enabled, and TIME is checked. If TIME is 0, the system is in the rest mode; as soon as a repeater is used, it will ID. When TIME is 1, the system is counting time to see if it is time to ID. In the program, if TIME is 0, the 150 PTT is checked to see if the repeater is in use. If not, the 450 PTT is checked at MAS2. If neither repeater is in use, the program loops around, continuously waiting for one to be used. When a repeater is activated, either a 150 code or a 450 code is put into MASK. MASK is a variable which tells the CW sending program which repeater to ID. At MAS3, TIME is made 1, and control goes to ID. At ID, TIMER is zeroed. TIMER is a four-byte counter, used to time up to three minutes. The repeater identifies, but before explaining how that occurs, the other path to ID will be explained.

At MASLP, if TIME is 1, control passes to MAS1. In this portion of the loop, the repeater has identified sometime in the past three minutes. In the subsequent three minutes, the processor keeps tab on the repeaters to see which ones should ID later. At MAS1, MASK is modified to reflect which repeaters are in use. TIMER is incremented, and, at MAS6, TIMER is checked to see if it equals IDTM (ID time). If not, three minutes have not elapsed, and the program loops back to MASLP. When time is up, control passes to ID, as before.

At ID, after TIMER is zeroed, MASK is checked to see if either repeater has been utilized in the last three minutes. If not, control resumes at MASLP after clearing TIME, placing the system back into the idle condition. If a repeater has been used, control goes to ID1. At this point, it must be determined which ID message is to be used. IDS (ID status) may have values from 1 to 7. 1 through 5 specify that that ID number is to be used, 6 indicates that the first four should be cycled, and 7 indicates that all five should be cycled. IDN (ID number) specifies the current ID number. IDN goes from 1 to 5. If IDS is between 1 and 5, IDN is set to IDS and control goes to ID3. At ID1, if IDS is 6 or 7, control goes to ID2 where IDN is incremented, advancing to the next ID message. At ID4 and ID5, IDN is checked to see if it is greater than it should be, and if so, it is set back to 1, and control goes to ID3.

At ID3, the HL registers

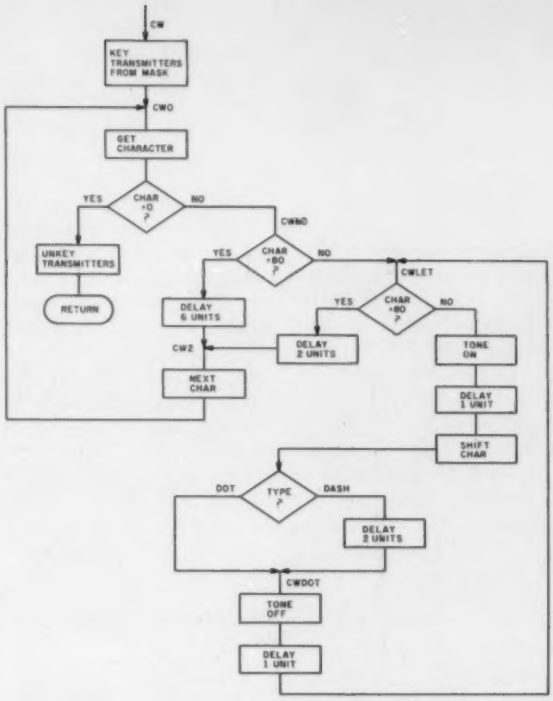

Fig. 2. CW routine.

are set to the address of the proper ID message, and the CW sending program is called. After sending the ID, MASK is zeroed and control goes to MASLP.

The CW sending routine is shown in Fig. 2. It is assumed that the address of the message to be sent in CW is in the HL registers, and that MASK indicates which repeaters to send the message to. If the destination is 150, MASK contains C0; if the destination is 450,

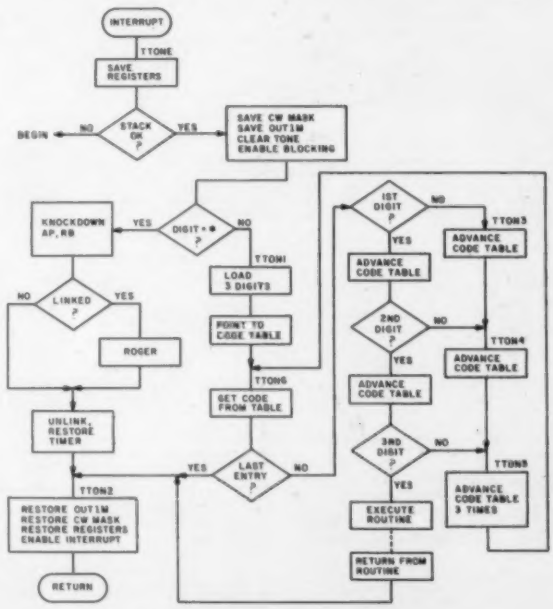

Fig. 3. Interrupt service routine.

MASK contains 30; if the destination is both, MASK contains F0. On entry, the proper transmitters are keyed, keeping them on the air for the duration of the message. At CW0, the character to be sent is fetched. A zero byte indicates that the message is done. If done, the transmitters are unkeyed, and the subroutine returns. Otherwise, at CWND (CW not done), the character is checked to see if it is the special space code of 80. If so, a 6-unit delay is made. A 1-unit delay is appended to every character, so a space is a total of 7 units long. If the character is not the special space code, control goes to CWLET (CW letter). Morse characters are stored left justified, with a 0 representing a dit and a 1 a dah. The byte is shifted left after each dit or dah, and when the byte ends up at 80, the character is done (described in *Byte*, October, 1976, page 36). After CWLET, the tone is turned on. If the character is a dah, an additional delay of 2 units is appended. At CWDOT, the tone is removed, and a trailing 1-unit space is added. The routine loops back to CWLET until the character is finished, where 2 more units are added to create a 3-unit intercharacter delay. At CW2, the next character is fetched and control loops back to CW0. The CW routine is used both by the ID section of the foreground program and various routines in the control section.

The Interrupt Service Program

The interrupt routine is shown in Fig. 3. When the 8080 is interrupted, it goes to address 38. It jumps to TTONE (touchtone), where the service routine is located. Since the foreground program may be interrupted at any time, it is necessary to save all registers. As an error-recovery technique, the stack pointer is checked to see if it is in the limited address space where RAM is located. If not, something is awry, and the program jumps to the beginning, resetting everything. If the stack is okay, MASK is saved, since it may need to be modified by the interrupt programs. OUT1M is saved because some bits are changed there as well. The CW tones are killed, in case an ID has been interrupted (which could leave a constant tone on the repeater until return to the foreground program), and BLK is set high, enabling the blocking function. The decoder is checked to see if the digit is a *, the knockdown digit. If so, the KD output is pulsed for about a millisecond to kill any possible autopatch or remote-base function. If the repeaters are linked, the routine ROGER is called, which sends the "R" in CW. The repeaters are unlinked, and the timeout timer is placed into the timing mode in case a single-digit autopatch was in progress. Control goes to TTON2, the exit point.

If the incoming digit is not a *, LOAD is called, which gets a three-digit code. The code table is checked for the three-digit code. If the code is not found in the table, control goes to TTON2, and nothing happens. If the code is found in the code table, the address of the routine to execute that particular code is obtained. At that point, the program jumps to the particular routine. After the routine is executed, control jumps to

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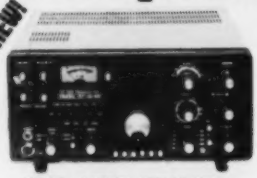

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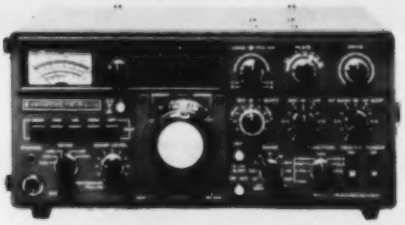

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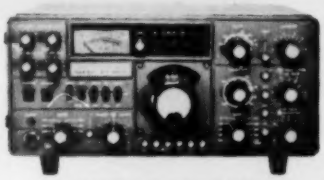

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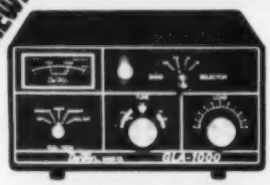

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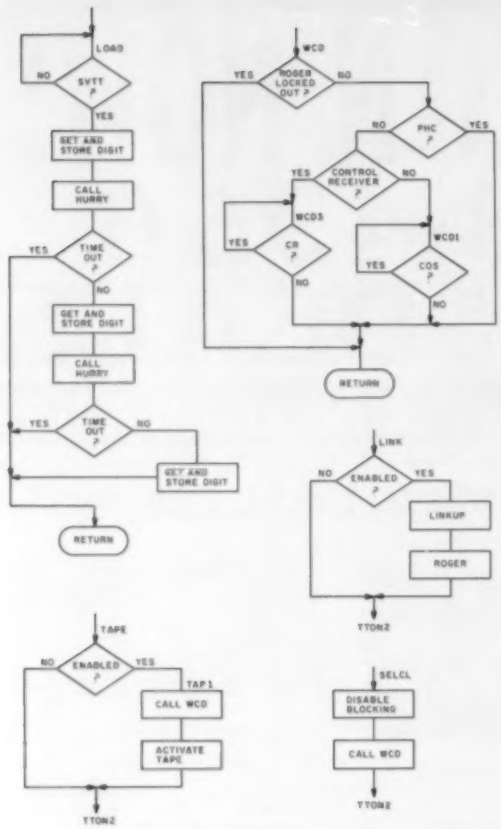

Fig. 4. Load, wait for carrier drop, link, tape, and selective call routines.

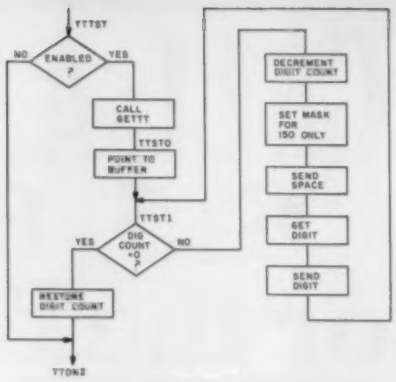

Fig. 5. Touchtone test routine.

TTON2.

At TTON2, everything that was saved upon entry of TTONE is restored and the interrupt routine returns to the foreground program.

BITS is a bit set routine used to set a bit in an output byte. The address of the byte is placed in register DE, and a 1 is placed in the desired bit in register B. BITC clears bits the same as BITS sets them.

Shown in Fig. 4, LOAD gets a three-digit code from the touchtone decoder. Upon entry, LOAD waits for SVTT. For user codes, SVTT is immediately present, since it is SVTT which caused the interrupt. For control codes, where several three-digit codes are used, LOAD waits for a code to be entered. When a digit is ready, LOAD calls DECOD. DECOD reads the input ports and decodes the digits into binary form. The digit is stored, and HURRY is called. HURRY checks VTT while counting time. If a tone occurs before three seconds elapse, HURRY returns with the carry clear. If no tone is received in three seconds, HURRY exits with the carry set. The timeout is detected in LOAD, the program is aborted, and LOAD returns. Otherwise DECOD gets the next digit, the sequence repeating. The third digit is fetched in the same manner. After exiting LOAD, either three digits are stored or an invalid code is stored because of failure to send successive digits within three seconds.

DECOD reads the decoder. Presumably, a tone is present when DECOD is called. The digits 1 through 9 are stored as those numbers, and 0, *, and # are stored as decimal 10, 11, and 12. A digit stored as 0 indicates an invalid code. LOAD presets the three digits to 0, so timing out results in one or more stored digits remaining 0

The routine WCD is used to wait for a carrier drop. It is possible to lock out the ROGER routine. If this is done, it also eliminates the need to wait for dropping carrier when controlling the repeater. Upon entry, WCD checks for this, and normally proceeds to check to see if it is in the phone control mode. If so, WCD returns. If not, it checks to see if the control receiver is being used. If so, it waits for the signal there to drop. If not, it waits for the COS signal to disappear. In this manner, WCD only waits when necessary, and waits for the proper signal. The LINK routine checks if the function is to be permitted. If so, it links the repeaters and calls ROGER.

The TAPE routine checks to see if the function is enabled, calls WCD, activates the tape, and exits.

The SELCL (selective call) routine clears BLK, calls WCD, and exits. This permits any tones after 3#3 and before the carrier drop to pass.

TTTST, the touchtone test routine, is shown in Fig. 5. If the function is enabled, GETTT (get touchtone) is called, which loads a sequence of digits. Control goes to TTST1, where the digit count is checked. For each digit, the digit is converted to CW and sent. The addresses of the CW conversions are at DIGAD. The actual CW codes are at CWD1 through CWDP. After the buffer is sent, the digit count is restored and TTTST exits.

The GETTT routine is shown in Fig. 6. Upon entry, the digit count is cleared and register pair DE is initialized to the start of the buffer. If carrier is present at GETT1, the VTT is checked. The program loops until either the carrier is dropped or a digit is received. When the latter happens, DECOD is called and the digit is placed into the buffer. The digit count is incremented, and checked to see if the buffer is full. The buffer is loaded in this manner until the carrier is dropped, when GETTT returns. If the buffer length reaches maximum, WCD is called and then GETTT returns.

When the three-digit control code is sent, the program goes to CNTRL, shown in Fig. 7. If the control mode is locked out, CNTRL exits immediately. Otherwise, WCD is called, and then LOAD. The HL registers are

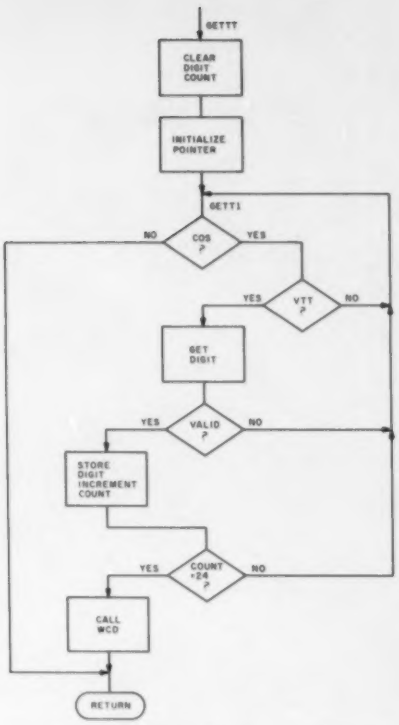

Fig. 6. Get touchtone routine.

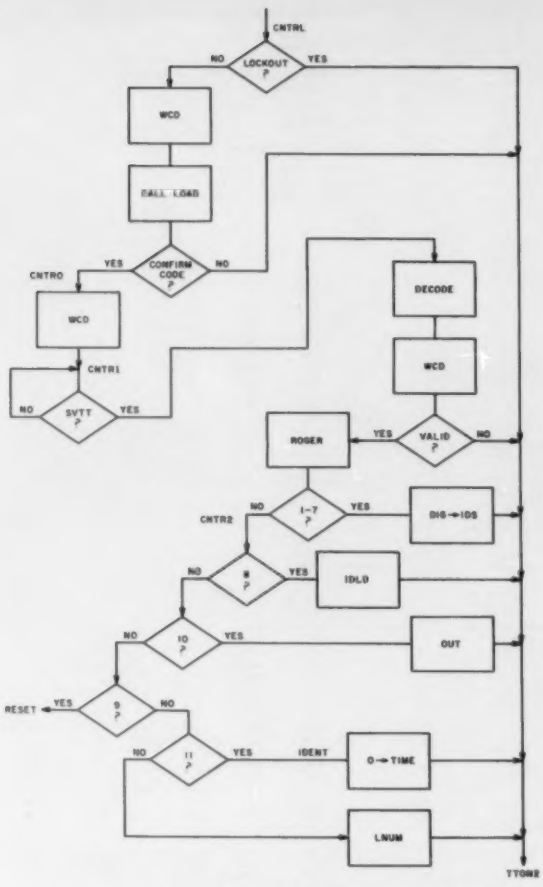

Fig. 7. Control routine.

loaded with the address of the confirm code. Jumping to TTON6 enters TTONE at a point where the code received is checked against the code table, now consisting only of the confirm code. If the received code is not in the single entry table, the interrupt is aborted as usual. If agreement is found, TTONE sends control to CNTR0, a continuation of CNTRL. WCD is called, and CNTRL then loops at CNTR1 until a tone is received. A single-digit code is expected, and DECOD is called to get it. WCD is again called, and if the received digit is invalid, control exits. Otherwise, ROGER is called and the proper program must be selected. If the received digit is between 1 and 7, IDS is loaded with that digit. The command is done, and CNTRL exits. If the digit is 8, CNTRL jumps to IDLD (ID load). A 10, which is digit 0, sends CNTRL to OUT, and 9 has the program jump to RESET, initializing the entire program with the exception of LOCK. If the digit is a *, TIME is cleared; otherwise, the digit must be a # and CNTRL jumps to LNUM (load number). Each routine, at completion, goes to TTON2 and exits.

Fig. 8 shows IDLD. The HL registers are loaded with the address of the programmable ID. The character byte in register B and element count in register C are cleared at IDLD0. IDLD1 waits for a digit to be received, and DECOD is called. If the digit is 3, the stop byte is stored, ROGER is called, and IDLD exits. Otherwise, control goes to IDNTS (ID not stop), where the digit is checked to see if it is a 2. If so, at IDDLT (ID done, left justify) register B is justified by the element count in register C. The character is stored in the message buffer at IDDL (ID done letter), HL is incremented, and control loops to IDLD0. If the digit is not a 2, it is checked to see if it is a 1. If it is, a 1 is shifted into register B and the element bit count is incremented. Otherwise, the digit is checked to see if it is a 0, where a 0 is shifted in. If the digit is not a 3, 2, 1, or a 0, then an invalid digit was sent and it is ignored.

The OUT routine, in Fig. 9, outputs selected bits to the output ports. LOAD is called to get a three-digit code. If the first digit is a *, ROGER is called and OUT exits. Otherwise, the digits are checked to see if they are 0, which is invalid. If an invalid entry is made, after carrier drop, control loops back to OUT. If port 0 is selected, the 10 is changed to a 0 for later use. Several validity checks are made, checking to see if port, bit numbers, and output levels make sense. If they do, ROGER is called. At OUT2, the binary code for the bit number is converted to a 1 in the proper bit of register E. At OPRT (output to port), a machine output instruction is set up in RAM with the required port number. The bit is either set or cleared, and the output instruction in RAM is called. Control loops to OUT, and the cycle continues until OUT is exited with a *.

LNUM (load number) is shown in Fig. 10. The digit count is zeroed, and at LNUM1 LNUM waits for a received digit. DECOD is called, and if the digit is a *, ROGER is called and the routine exits. Otherwise, the digit count is checked and the digit is stored. If more than 11 digits are attempted, the last digit keeps being overwritten.

LOCK has two functions.

```
                        ;REPEATER CONTROL SYSTEM MONITOR PROGRAM
                        ;
                        ;FOR USE WITH AN 8088 CONTROLLER
                        ;WITH I/O PORTS
                        ;AND THE NECESSARY EXTERNAL HARDWARE
                        ;INCLUDING A TOUCH TONE (R) DECODER
                        ;
                        ;
                        ;
                        ;VERSION 2.0
                        ;
                        ;SERIES 2 INCORPORATES ERROR RECOVERY
                        ;
                        ;NOVEMBER 1977, ROBERT GLASER M3IC
                        ;MODIFIED FEBRUARY, 1978
                        ;COPYRIGHT ROBERT GLASER
                        ;
                        ;
                        ;
PSW:    EQU     6
SP:     EQU     8
PORT1:  EQU     10H
PORT2:  EQU     20H
PORT3:  EQU     30H
PORT4:  EQU     40H
PORT5:  EQU     50H
PORT6:  EQU     60H
PORT7:  EQU     70H
CNSPB:  EQU     2000
IDTM0:  EQU     0
IDTM1:  EQU     0
IDTM2:  EQU     26
IDTM3:  EQU     0
                        ;
                        ;
                        ;
                        ORG     0       ;FIRST ORG
                        ;INITIALIZATION PROCEDURE
                        ;
                        ;
                        ;
0000 AF         BEGIN:  XRA     A
0001 32 F2 30           STA     LCKR
0004 21 F4 30   RESET:  LXI     H,TIME-1
0007 23         RST1:   INX     H
0008 36 00              MVI     M,0
000A 3E FF              MVI     A,0FFH
000C BD                 CMP     L
000D C2 07 00           JNZ     RST1
0010 AF                 XRA     A
0011 D3 10              OUT     PORT1
0013 D3 20              OUT     PORT2
0015 D3 30              OUT     PORT3
0017 D3 40              OUT     PORT4
0019 D3 50              OUT     PORT5
001B D3 60              OUT     PORT6
001D 3C                 INR     A
001E 32 F3 30           STA     IDS     ;ID STATUS
0021 32 F4 30           STA     IDN     ;ID NUMBER
0024 3E FF              MVI     A,0FFH
0026 32 FF 30           STA     OUTFR
0029 D3 70              OUT     PORT7
002B 2A 00 10           LHLD    STCK    ;STACK LOC
002E F9                 SPHL
002F C3 38 00           JMP     MASLP   ;BYPASS INT LOC
                        ;
                        ;
                        ;
                        ORG     38H     ;INTERRUPT LOCATION
                        JMP     TYONE   ;INTERRUPT PROGRAM
                        ;
                        ;
                        ;
                MASLP:  EQU     $       ;MASTER LOOP
                        EI
0038 FB                 LDA     TIME
0039 3A F5 30           ORA     A
003C B7                 JNZ     MAS1    ;TIMING
003D C2 65 00           IN      PORT1
0040 DB 10              CMA
0042 2F                 ANI     38H     ;130 PTT
0043 E6 20              JZ      MAS2
0045 CA 50 00           MVI     A,0C0H
0048 3E C0              STA     MASK    ;50 MASK
004A 32 F6 30   MAS3:   MVI     A,1
004D 3E 01              STA     TIME    ;START TIMING
004F 32 F5 30           JMP     ID      ;IDENTIFY
0052 C3 03 00           IN      PORT1
0055 DB 10      MAS2:   CMA
0057 2F                 ANI     18H     ;400 PTT
0058 E6 18              JZ      MASLP   ;NO ACTIVITY
005A CA 38 00           MVI     A,38H   ;400 MASK
005D 3E 38              JMP     MAS3
005F C3 49 00           IN      PORT1
0062 DB 10      MAS1:   CMA
0064 2F                 PUSH    PSW
0065 F5                 ANI     20H     ;130 PTT
0066 E6 20              JZ      MAS6
0068 CA 75 00           LXI     H,MASK
006B 21 F6 30           MVI     A,0C0H
006E 3E C0              ORA     M
0070 B6                 MOV     M,A
0071 77                 POP     PSW
0072 F1         MAS4:   ANI     10H     ;400 PTT
0073 E6 10              JZ      MAS5
0075 CA 82 00           LXI     H,MASK
0078 21 F6 30           MVI     A,38H
007B 3E 38              ORA     M
007D B6                 MOV     M,A
007E 77                 LXI     H,TIMER ;INCR 4 BYTE TIMER
007F 21 ED 30   MAS5:   INR     M
0082 34                 JNZ     MAS6
0083 C2 95 00
0086 23
0087 34
0088 C2 95 00
008B 23
008C 34
008D C2 95 00   MAS6:   LXI     H,TIMER ;SEE IF TIME
0090 21 ED 30           MVI     A,IDTM0 ;IS UP
0093 3E 00              CMP     M
0095 BE                 JNZ     MASLP   ;NOPE
0096 C2 38 00           INX     H
0099 23                 MVI     A,IDTM1
009A 3E 00              CMP     M
009C BE                 JNZ     MASLP   ;NOPE
009D C2 38 00           INX     H
00A0 23                 MVI     A,IDTM2
00A1 3E 1A              CMP     M
00A3 BE                 JNZ     MASLP   ;NOPE
00A4 C2 38 00           INX     H
00A7 23                 MVI     A,IDTM3
00A8 3E 00              CMP     M
00AA BE                 JNZ     MASLP   ;NOPE
00AB C3 38 00
                        ;
                        ;
                        ;
                ID:     EQU     $       ;TIME TO ID IF MASK NONZERO
00AE 21 00 00           LXI     H,0
00B1 22 ED 30           SHLD    TIMER
00B4 22 EF 30           SHLD    TIMER+2
00B7 21 F4 30           LXI     H,IDN
00BA 3A F6 30           LDA     MASK
00BD B7                 ORA     A
00BE C2 CC 00           JNZ     ID1
00C1 32 F5 30           STA     TIME    ;STOP TIMING
00C4 C3 38 00           JMP     MASLP
00C7 3A F3 30   ID1:    LDA     IDS     ;ID STATUS
00CA FE 06              CPI     6       ;< 6?
00CC D2 DA 00           JNC     ID2
00CF 32 F4 30           STA     IDN     ;ID NUMBER
00D2 C3 F3 00           JMP     ID3
00D5 34         ID2:    INR     M
00D6 3A F3 30           LDA     IDS
00D9 FE 06              CPI     6
00DB CA EE 00           JZ      ID4
00DE 3E 09              MVI     A,9
00E0 BE         ID3:    CMP     M
00E1 D2 F3 00           JNC     ID3
00E4 36 01              MVI     M,1
00E6 C3 F3 00           JMP     ID3
00E9 3E 04      ID4:    MVI     A,4
00EB C3 E8 00           JMP     ID5
00EE 7E         ID3:    MOV     A,M
00EF 3D                 DCR     A
00F0 07                 RLC
00F1 5F                 MOV     E,A
00F2 16 00              MVI     D,0
00F4 21 08 10           LXI     H,IDAD
00F7 19                 DAD     D
00F8 7E                 MOV     E,M
00F9 23                 INX     H
00FA 56                 MOV     D,M
00FB EB                 XCHG
00FC CD 08 01           CALL    CW
00FF AF                 XRA     A
0100 32 F6 30           STA     MASK    ;CLEAR MASK
0103 C3 38 00           JMP     MASLP
                        ;
                        ;
                        ;CW SENDING ROUTINE
                        ;ROTATES DATA LEFT.
                        ;1 IS A DASH, 0 IS A DOT
                        ;UNTIL AN 80 IS LEFT.
                        ;AN INITIAL 80 IS A SPACE
                        ;AND A ZERO IS MESSAGE END
                        ;
                        ;
0108            CW:     EQU     $       ;CW SENDING ROUTINE
0108 3A F6 30           LDA     MASK
010B E6 50              ANI     50H
010D 47                 MOV     B,A
010E 11 F9 30           LXI     D,OUTIN
0111 CD 0C 02           CALL    BITB
0114 D3 10              OUT     PORT1
0116 7E         CW0:    MOV     A,M
0117 B7                 ORA     A
0118 C2 29 01           JNZ     CW00
011B 11 F9 30           LXI     D,OUTIN
011E 3E 06              MVI     A,0F0H
0120 CD 10 02           CALL    BITC
0123 D3 10              OUT     PORT1
0125 C9                 RET
0126 FE 80      CW00:   CPI     80H
0128 C2 3B 01           JNZ     CW1ET
012B 3E 06              MVI     A,6     ;SPACE
012D CD 74 01   CW1:    CALL    DELAY
0130 3D                 DCR     A
0131 C2 30 01           JNZ     CW1
0134 23         CW2:    INR     M
0135 C3 19 01           JMP     CW0     ;GET NEXT CHAR
0138 FE 00      CW1ET:  CPI     00H     ;DONE?
013A CC 74 01           CZ      DELAY   ;2 SPACES
013D CC 74 01           CZ      DELAY   ;AT END
0140 C8                 JZ      CW0     ;LETTER DONE
0141 F5                 PUSH    PSW
0142 11 F9 30           LXI     D,OUTIN
0145 3A F6 30           LDA     MASK
0148 E6 A0              ANI     0A0H
014A 47                 MOV     B,A
014B CD 0C 02           CALL    BITB
014E D3 10              OUT     PORT1   ;OUT TONE
```

Program listing.

It can block access to the control mode, and it can eliminate the ROGER routine. After the LOCK sequence is given, LOAD is called to get three digits. The second digit eliminates the ROGER routine if it is a 1, and the third digit locks the control mode out if it is a 1. ROGER is then called, and LOCK exits. If the second or third digits of a LOCK command are 0, the normal state of the appropriate function is resumed. The LOCK function is intended as a fail-safe measure, available only to the person who constructs the system. The reset instruction (9) is purposely constructed so that it does not reset LCKR, the locker

```
0327 0155 F1                    POP     PSW
0328 0156 CD 74 01              CALL    DELAY
0329 0159 37                    RAL
0330 015A F5                    PUSH    PSW
0331 015B D2 64 01              JNC     CWDOT
0332 015E CD 74 01              CALL    DELAY
0333 0161 CD 74 01              CALL    DELAY
0334 0164 06 A8         CWDOT:  MVI     B,0A8H
0335 0166 CD 10 02              CALL    BITC
0336 0169 D3 10                 OUT     PORT1
0337 016B CD 74 01              CALL    DELAY
0338 016E F1                    POP     PSW             ;GET CHAR
0339 016F E6 FE                 ANI     0FEH
0340 0171 C3 3B 01              JMP     CULET
0341 0174               ;
0342 0174               ;
0343 0174               ;
0344 0174 D5            DELAY:  PUSH    D
0345 0175 F5                    PUSH    PSW
0346 0176 11 88 13              LXI     D,CWSPD
0347 0179 AF                    XRA     A
0348 017A 1B            DEL1:   DCX     D
0349 017B B8                    CMP     E
0350 017C C2 7A 01              JNZ     DEL1
0351 017F BA                    CMP     D
0352 0180 C2 7A 01              JNZ     DEL1
0353 0183 F1                    POP     PSW
0354 0184 D1                    POP     D
0355 0185 C9                    RET
0356 0186               ;
0357 0186               ;
0358 0186               ;
0359 0186               TTONE:  EQU     $
0360 0186               ;INTERRUPT ROUTINE TO SERVICE
0361 0186               ;TOUCH TONE (R) DECODER
0362 0186               ;
0363 0186               ;HANDLES ALL CONTROL AND USER FUNCTIONS
0364 0186               ;
0365 0186               ;
0366 0186 F5                    PUSH    PSW
0367 0187 C5                    PUSH    B
0368 0188 D5                    PUSH    D
0369 0189 E5                    PUSH    H
0370 018A 21 00 00              LXI     H,0     ;SEE IF
0371 018D 39                    DAD     SP      ;THE STACK
0372 018E 7C                    MOV     A,H     ;IS NESSED
0373 018F FE 30                 CPI     30H     ;UP
0374 0191 C2 A0 00              JNZ     BEGIN   ;YES, RECOVER
0375 0194 3A F6 30              LDA     MASK
0376 0197 F5                    PUSH    PSW
0377 0198 11 F9 30              LXI     D,OUTIM
0378 019B 1A                    LDAX    D
0379 019C F5                    PUSH    PSW
0380 019D 06 F8                 MVI     B,0F8H
0381 019F CD 10 02              CALL    BITC    ;BIT CLEAR
0382 01A2 06 01                 MVI     B,1
0383 01A4 CD 0C 02              CALL    BITS    ;BIT SET
0384 01A7 D3 10                 OUT     PORT1
0385 01A9 DB 20                 IN      PORT2
0386 01AB 2F                    CMA
0387 01AC E6 02                 ANI     2
0388 01AE CA 03 01              JZ      TTON1   ;NOT *
0389 01B1 06 02                 MVI     B,2
0390 01B3 CD 0C 02              CALL    BITS
0391 01B6 D3 10                 OUT     PORT1   ;KNOCKDOWN
0392 01B8 CD 74 01              CALL    DELAY
0393 01BB CD 10 02              CALL    BITC    ;RELEASE FORCE
0394 01BE D3 10                 OUT     PORT1
0395 01C0 11 F8 30              LXI     D,OUT3H
0396 01C3 1A                    LDAX    D
0397 01C4 E6 10                 ANI     10H     ;LINKED?
0398 01C6 C4 D2 03              CNZ     ROGER   ;YES
0399 01C9 06 10                 MVI     B,10H
0400 01CB CD 10 02              CALL    BITC    ;RESTORE TIMER A
0401 01CE D3 30                 OUT     PORT3   ;UNLINK RPTR6
0402 01D0 C3 FC 01              JMP     TTON2
0403 01D3 CD 19 02      TTON1:  CALL    LOAD
0404 01D6 2A 02 10              LHLD    CDTAB   ;LOCATION OF CODTB
0405 01D9 7E            TTON6:  MOV     A,M
0406 01DA B7                    ORA     A
0407 01DB CA FC 01              JZ      TTON2   ;NOT CODE
0408 01DE BA                    CMP     D
0409 01DF C2 F4 01              JNZ     TTON3
0410 01E2 23                    INX     H
0411 01E3 7E                    MOV     A,M
0412 01E4 BB                    CMP     E
0413 01E5 C2 F3 01              JNZ     TTON4
0414 01E8 23                    INX     H
0415 01E9 7E                    MOV     A,M
0416 01EA BA                    CMP     D
0417 01EB C2 F6 01              JNZ     TTON5
0418 01EE 23                    INX     H
0419 01EF 5E                    MOV     E,M
0420 01F0 23                    INX     H
0421 01F1 56                    MOV     D,M
0422 01F2 EB                    XCHG            ;ADDR TO HL
0423 01F3 E9                    PCHL            ;JUMP TO IT
0424 01F4 23            TTON3:  INX     H
0425 01F5 23            TTON4:  INX     H
0426 01F6 23            TTON5:  INX     H
0427 01F7 23                    INX     H
0428 01F8 23                    INX     H
0429 01F9 C3 D9 01              JMP     TTON6   ;TRY NEXT CODE
0430 01FC               ;
0431 01FC F1            TTON2:  POP     PSW
0432 01FD 32 F9 30              STA     OUTIM
0433 0200 D3 10                 OUT     PORT1
0434 0202 F1                    POP     PSW
0435 0203 32 F6 30              STA     MASK
0436 0206 E1                    POP     H
0437 0207 D1                    POP     D
0438 0208 C1                    POP     B
0439 0209 F1                    POP     PSW
0440 020A FB                    EI
0441 020B C9                    RET             ;AND EXIT INTERRUPT
0442 020C               ;
0443 020C               ;
0444 020C               ;
0445 020C               ;
0446 020C               ;
0447 020C               ;
0448 020C               BITS:   EQU     $
0449 020C               ;BIT SET SETS THE BIT CORRESPONDING
0450 020C               ;TO THAT OF REG B IN MEM LOC (DE)
0451 020C               ;
0452 020C 1A                    LDAX    D
0453 020D B0                    ORA     B
0454 020E 12                    STAX    D
0455 020F C9                    RET
0456 0210               ;
0457 0210               ;
0458 0210               BITC:   EQU     $
0459 0210               ;BIT CLEAR CLEARS THE BIT
0460 0210 C5                    PUSH    B
0461 0211 78                    MOV     A,B
0462 0212 2F                    CMA
0463 0213 47                    MOV     B,A
0464 0214 1A                    LDAX    D
0465 0215 A0                    ANA     B
0466 0216 12                    STAX    D
0467 0217 C1                    POP     B
0468 0218 C9                    RET
0469 0219               ;
0470 0219               ;
0471 0219               ;
0472 0219               LOAD:   EQU     $
0473 0219               ;LOAD PUTS THE SEQUENTIAL 3 DIGIT CODE
0474 0219               ;INTO REG'S D,E,B
0475 0219               ;REG'S CLEAR IF NO DIGIT
0476 0219               ;LOAD WAITS FOR A LONG FIRST TONE
0477 0219               ;AND THEN FAST TWO TONES
0478 0219               ;
0479 0219 11 00 00              LXI     D,0
0480 021C 01 00 00              LXI     B,0
0481 021F DB 10         LOAD1:  IN      PORT1
0482 0221 2F                    CMA
0483 0222 B7                    ORA     A
0484 0223 F2 1F 02              JP      LOAD1   ;WAIT FOR LONG TONE
0485 0226 CD 3B 02              CALL    DECOD   ;GET DIGIT
0486 0229 57                    MOV     D,A
0487 022A CD 48 02              CALL    HURRY
0488 022D D8                    RC              ;TIMED OUT
0489 022E CD 3B 02              CALL    DECOD
0490 0231 5F                    MOV     E,A
0491 0232 CD 48 02              CALL    HURRY
0492 0235 D8                    RC
0493 0236 CD 3B 02              CALL    DECOD
0494 0239 47                    MOV     B,A
0495 023A C9                    RET
0496 023B               ;
0497 023B               ;
0498 023B               ;
0499 023B               DECOD:  EQU     $
0500 023B               ;DECOD READS THE TOUCH TONE (R) DECODER
0501 023B               ;AND PUTS THE CHAR IN REG A
0502 023B               ;NO TONE RETURNS A ZERO
0503 023B               ;WAIT FOR RELEASE OF TONE BEFORE RETURN
0504 023B               ;
0505 023B C5                    PUSH    B
0506 023C DB 10                 IN      PORT1
0507 023E 2F                    CMA
0508 023F E6 0F                 ANI     0FH
0509 0241 C2 50 02              JNZ     DEC01   ;IN PORT 1
0510 0244 DB 20                 IN      PORT2
0511 0246 2F                    CMA
0512 0247 B7                    ORA     A
0513 0248 CA 5C 02              JZ      DEC04   ;ERRONEOUS CHRX
0514 024B 0E 04                 MVI     C,4     ;OFFSET
0515 024D C3 56 02              JMP     DEC02
0516 0250 17            DEC01:  RAL
0517 0251 17                    RAL
0518 0252 17                    RAL
0519 0253 17                    RAL
0520 0254 0E 00                 MVI     C,0
0521 0256 0C            DEC02:  INR     C
0522 0257 17                    RAL
0523 0258 D2 56 02              JNC     DEC02
0524 025B 79                    MOV     A,C
0525 025C C1            DEC04:  POP     B
0526 025D F5                    PUSH    PSW
0527 025E DB 10         DEC03:  IN      PORT1
0528 0260 2F                    CMA
0529 0261 E6 40                 ANI     40H
0530 0263 C2 5E 02              JNZ     DEC03
0531 0266 F1                    POP     PSW
0532 0267 C9                    RET
0533 0268               ;
0534 0268               ;
0535 0268               ;
0536 0268               HURRY:  EQU     $
0537 0269               ;HURRY WAITS FOR A TONE.
0538 0269               ;BUT EXITS WITH CARRY SET IF NONE
0539 0269               ;RECEIVED IN PERMITTED TIME
0540 0269               ;
0541 0269 AF                    XRA     A
0542 026A D5                    PUSH    D
0543 026B C5                    PUSH    B
0544 026C 11 00 00              LXI     D,0
0545 026F 01 00 00              LXI     B,0
0546 0272 DB 10         HURY1:  IN      PORT1
0547 0274 2F                    CMA
0548 0275 E6 40                 ANI     40H     ;TONE?
```

Continued on next page

where the control mode may be inhibited.

PATCH, the autopatch routine, is one of the more complicated subprograms. Shown in Fig. 11, PATCH first checks to see if the autopatch is enabled. NOTIM (no timer) is cleared so that the timer will be present unless changed later. GETTT gets the requested telephone number. The digit count is then checked. If no number was sent, and a direct autopatch is allowed, then at PTCH1 AP is pulsed, giving the user the line to dial his own number. Otherwise, the attempt is aborted. If 7 digits were entered, control passes through PTCH2 to PTCH8. If the first digit of the number is a 1, the patch is aborted. If not, at PTCH3 AP is pulsed, bringing up the line. At PTCH5, a one-second delay is introduced to allow time for the telephone company equipment to produce the dial tone.

```
0449 0274 C2 98 02          JNZ     HURY3   ;YES
0450 0279 0C                INR     C
0451 027A C2 86 02          JNZ     HURY2
0452 027D 04                INR     B
0453 027E C2 86 02          JNZ     HURY2
0454 0281 1C                INR     E
0455 0282 C2 86 02          JNZ     HURY2
0456 0285 14                INR     D
0457 0286 3E 01     HURY2:  MVI     A,1
0458 0288 B8                CMP     E
0459 0289 C2 71 02          JNZ     HURY1
0460 028C 37                STC                 ;TIMED OUT
0461 028D C1        HURY3:  POP     B
0462 028E D1                POP     D
0463 028F C9                RET
0464 0290 ;
0465 0290 ;
0466 0290 ;
0467 0290 WCD:  EQU     $
0468 0290 ;WAIT FOR CARRIER DROP
0469 0290 F5                PUSH    PSW
0470 0291 3A F7 30          LDA     LXROG
0471 0294 B7                ORA     A
0472 0295 C2 B5 02          JNZ     WCD2
0473 0298 DB 70             IN      PORT3
0474 029A B7                ORA     A
0475 029B FA B5 02          JM      WCD2
0476 029E E6 40             ANI     40H
0477 02A0 CA A8 02          JZ      WCD1    ;NOT CK
0478 02A3 DB 70     WCD3:   IN      PORT3
0479 02A5 E6 40             ANI     40H
0480 02A7 C2 A3 02          JNZ     WCD3
0481 02AA C3 B9 02          JMP     WCD2
0482 02AD DB 10     WCD1:   IN      PORT1
0483 02AF 2F                CMA
0484 02B0 E6 20             ANI     20H
0485 02B2 C2 A0 02          JNZ     WCD1
0486 02B5 F1        WCD2:   POP     PSW
0487 02B6 C9                RET
0488 02B7 ;
0489 02B7 ;
0490 02B7 ;
0491 02B7 3A F8 30  LINK:   LDA     OUTON   ;LINK RPTER
0492 02BA E6 01             ANI     1       ;ENABLED?
0493 02BC C2 FC 01          JNZ     TTCH2   ;NO!
0494 02BF 11 F8 30          LXI     D,OUT3N
0495 02C2 06 10             MVI     B,10H
0496 02C4 CD 0C 02          CALL    BITB
0497 02C7 93 30             OUT     PORT3
0498 02C9 CD D2 03          CALL    ROGER
0499 02CC C3 FC 01          JMP     TTCH2
0500 02CF ;
0501 02CF ;
0502 02CF ;
0503 02CF 3A F8 30  TAPE:   LDA     OUTON   ;TAPE LOOP
0504 02D2 E6 02             ANI     2       ;ENABLED?
0505 02D4 C2 FC 01          JNZ     TTCH2   ;NO!
0506 02D7 CD 98 02  TAP1:   CALL    WCD
0507 02DA 11 F8 30          LXI     D,OUT3N
0508 02DD 06 08             MVI     B,08H
0509 02DF CD 0C 02          CALL    BITB
0510 02E2 93 30             OUT     PORT3
0511 02E4 CD 74 01          CALL    DELAY
0512 02E7 CD 10 02          CALL    BITC    ;PULSE TAPE
0513 02EA 93 30             OUT     PORT3
0514 02ED C3 FC 01          JMP     TTCH2
0515 02EF ;
0516 02EF ;
0517 02EF ;
0518 02EF ;SELECTIVE CALL DISABLES TONE BLOCKING
0519 02EF 11 F9 30  SELCL:  LXI     D,OUTIN
0520 02F2 06 01             MVI     B,1
0521 02F4 CD 10 02          CALL    BITC
0522 02F7 93 10             OUT     PORT1
0523 02F9 CD 98 02          CALL    WCD     ;WAIT FOR CAR DROP
0524 02FC C3 FC 01          JMP     TTCH2
0525 02FF ;
0526 02FF ;
0527 02FF ;
0528 02FF           CNTRL:  EQU     $
0529 02FF           ;ALL CONTROL CODES ARE ENTERED
0530 02FF           ;IN THIS ROUTINE.
0531 02FF ;
0532 02FF 3A F2 30          LDA     LCKR
0533 0302 B7                ORA     A
0534 0303 C2 FC 01          JNZ     TTCH2   ;LOCKED OUT
0535 0306 CD 98 02          CALL    WCD
0536 0309 CD 19 02          CALL    LOAD
0537 030C 3A 04 10          LHLD    CFRNC
0538 030F C3 D9 01          JMP     TTCH6
0539 0312 CD 98 02  CNTR0:  CALL    WCD
0540 0315 DB 10     CNTR1:  IN      PORT1
0541 0317 2F                CMA
0542 0318 B7                ORA     A
0543 0319 F2 15 03          JP      CNTR1
0544 031C CD 3B 02          CALL    DECOD   ;GET DIGIT
0545 031F CD 98 02          CALL    WCD
0546 0322 B7                ORA     A
0547 0323 CA FC 01          JZ      TTCH2
0548 0326 FE 0A             CPI     10
0549 0328 D2 FC 01          JNC     TTCH2   ;INVALID
0550 032B CD D2 03          CALL    ROGER
0551 032E FE 08             CPI     8
0552 0330 D2 39 03          JNC     CNTR2
0553 0333 32 F3 30          STA     IDS
0554 0336 C3 FC 01          JMP     TTCH2   ;DONE
0555 0339 FE 08     CNTR2:  CPI     8
0556 033B CA A0 10          JZ      IDLD    ;LOAD ID
0557 033E FE 0A             CPI     10
0558 0340 CA 50 03          JZ      OUT
0559 0343 FE 09             CPI     9
0560 0345 CA 04 00          JZ      RESET   ;INIT
0561 0348 FE 0B             CPI     11
```

```
0562 034A CA F8 03          JZ      IDENT
0563 034D C3 12 10          JMP     LMONA   ;LOAD NUMBER
0564 0350 ;
0565 0350 ;
0566 0350           OUT:    EQU     $
0567 0350           ;OUT TAKES 3 DIGITS AND OUTPUTS
0568 0350           ;TO OUTPUT PORTS AS FOLLOWS:
0569 0350           ;TT CODE IS XYZ
0570 0350           ;PORT N 0,1,2,3,4,5,6,7
0571 0350           ;BIT Y  1,2,3,4,5,6,7,8
0572 0350           ;LEVEL Z        0,1
0573 0350 ;
0574 0350 ;ALL FAULTY CODES ARE IGNORED
0575 0350 ;
0576 0350 ;A * EXITS THE CONTROL-OUT MODE
0577 0350 ;
0578 0350 CD 19 02          CALL    LOAD
0579 0353 3E 0B             MVI     A,11    ;*
0580 0355 BA                CMP     D
0581 0356 C2 5F 03          JNZ     OUT1
0582 0359 CD D2 03          CALL    ROGER
0583 035C C3 FC 01          JMP     TTCH2   ;EXIT
0584 035F AF        OUT1:   XRA     A
0585 0360 BA                CMP     D
0586 0361 CA CC 03          JZ      OUTR    ;NO GOOD
0587 0364 BB                CMP     E
0588 0365 CA CC 03          JZ      OUTR
0589 0368 7A                MOV     A,D
0590 0369 FE 0A             CPI     10
0591 036B C2 73 03          JNZ     OUT4
0592 036E 16 00             MVI     D,0
0593 0370 C3 79 03          JMP     OUT5
0594 0373 3E 07     OUT4:   MVI     A,7
0595 0375 BA                CMP     D
0596 0376 DA CC 03          JC      OUTR
0597 0379 3E 08     OUT5:   MVI     A,8
0598 037B BB                CMP     E
0599 037C DA CC 03          JC      OUTR
0600 037F 3E 01             MVI     A,1
0601 0381 BB                CMP     E
0602 0382 CA 0E 03          JZ      OUT3
0603 0385 3E 0A             MVI     A,10
0604 0387 BB                CMP     E
0605 0388 CA 0E 03          JZ      OUT3
0606 038B C3 CC 03          JMP     OUTR
0607 038E CD D2 03  OUT3:   CALL    ROGER
0608 0391 3E A0             MVI     A,80H
0609 0393 07        OUT2:   RLC
0610 0394 1D                DCR     E
0611 0395 C2 93 03          JNZ     OUT2
0612 0398 5F                MOV     E,A
0613 0399 7A                MOV     A,D
0614 039A 07        OPRT:   RLC             ;PORT #
0615 039B 07                RLC             ;TIMES ION
0616 039C 07                RLC
0617 039D 07                RLC
0618 039E 32 EB 30          STA     OUTR2
0619 03A1 78                MOV     A,B     ;LEVEL
0620 03A2 43                MOV     B,E     ;BIT #
0621 03A3 3D                DCR     A
0622 03A4 F5                PUSH    PSW
0623 03A5 7A                MOV     A,D
0624 03A6 11 F8 30          LXI     D,OUTON
0625 03A9 83                ADD     E
0626 03AA 5F                MOV     E,A
0627 03AB 7A                MOV     A,D
0628 03AC CE 00             ACI     0
0629 03AE 57                MOV     D,A
0630 03AF 3E 03             MVI     A,0D3H
0631 03B1 32 EA 30          STA     OUTR1   ;OUT INSTR
0632 03B4 3E C9             MVI     A,0C9H
0633 03B6 32 EC 30          STA     OUTR3   ;RETURN INSTR
0634 03B9 F1                POP     PSW
0635 03BA CA C6 03          JZ      OPRT1
0636 03BD CD 10 02  OPRT0:  CALL    BITC
0637 03C0 CD EA 30  OPRT2:  CALL    OUTR1   ;OUTPUT
0638 03C3 C7 50 03          JMP     OUT     ;GET NEXT CMD
0639 03C6 CD 0C 02  OPRT1:  CALL    BITB
0640 03C9 C3 C0 03          JMP     OPRT2
0641 03CC CD 98 02  OUTR:   CALL    WCD
0642 03CF C7 50 03          JMP     OUT
0643 03D2 ;
0644 03D2 ;
0645 03D2 ;
0646 03D2 ;
0647 03D2 ;
0648 03D2 CD 98 02  ROGER:  EQU     $
0649 03D5 F5        ;ROGER SENDS AN 'R' IN MORSE
0650 03D6 3A F7 30          CALL    WCD
0651 03D9 B7                PUSH    PSW
0652 03DA C2 F6 03          LDA     LXROG
0653 03DD C5                ORA     A
0654 03DE D5                JNZ     ROG1
0655 03DF C5                PUSH    H
0656 03E0 3A F6 30          PUSH    D
0657 03E3 F5                PUSH    B
0658 03E4 3E C0             LDA     MASK
0659 03E6 32 F6 30          PUSH    PSW
0660 03E9 2A 06 10          MVI     A,0C0H
0661 03EC CD 0B 01          STA     MASK
0662 03EF F1                LHLD    RMSGA   ;LOC OF RMSG
0663 03F0 32 F6 30          CALL    CW
0664 03F3 C1                POP     PSW
0665 03F4 D1                STA     MASK
0666 03F5 E1                POP     B
0667 03F6 F1                POP     D
0668 03F7 C9                POP     H
0669 03F8           ROG1:   POP     PSW
0670 03F8                   RET
0671 03F9 ;
0672 03F9 ;
0673 03F9 ;
0674 03F9 AF        ;FORCE A REPEATED IDENTIFICATION
0675 03FA 32 F5 30  IDENT:  XRA     A
                            STA     TIME    ;FORCE AN ID
```

Our exchange is an electronic switching system and is very rapid. If it commonly takes longer than one second at your exchange, change the number 15 to a larger number in line #1057. A 1 is sent to the LD output, preparing to dial the number. At PTCH6, the number is dialed. Each tone is on for 65 ms and off for 65 ms, the time DELAY waits. The binary digit numbers are converted to the proper row and column format by the TTTAB (touchtone table). When the number is completed, LD is turned off, and if NOTIM is not 0, the timer is disabled. Similarly, if 8 or 11 digits are requested and the first digit is a 0, the same procedure applies. If a single-digit number is requested, a table is searched at PCH10. The single digit table, SDTAB, has the single digit followed by the address of the corresponding telephone number. At the loca-

```
0675 03FC C3 FE 01          JMP     TTOH2
0676 03FF                   ;
0677 03FF                   ;
0678 03FF                   ;
0679 03FF                   ORG     1000H   ;SECOND BOX
0680 1000 EA 38             STCK:   DW      STACK
0681 1002 15 10             CDTAB:  DW      CDBTB
0682 1004 49 10             CFNCD:  DW      CFNCD
0683 1006 9A 10             RMSG:   DW      RMSG
0684 1008 4E 10             IDAD:   DW      ID4D1
0685 100A 5F 10                     DW      ID4D2
0686 100C 75 10                     DW      ID4D3
0687 100E 84 10                     DW      ID4D4
0688 1010 25 30                     DW      ID4D5
0689 1012 C7 12 13          LNUM:   JMP     LNUM
0690 1015                   ;
0691 1015 09                CDBTB:  DB      6
0692 1016 04                        DB      7
0693 1017 0C                        DB      12      ;#
0694 1018 B7 11                     DW      PATCH
0695 101A 03                        DB      9
0696 101B 0C                        DB      12      ;#
0697 101C 00                        DB      5
0698 101D AF 12                     DW      RBASE
0699 101F 03                        DB      3
0700 1020 0C                        DB      12      ;#
0701 1021 01                        DB      1
0702 1022 EF 02                     DW      SELCL
0703 1024 0:                        DB      1
0704 1025 0C                        DB      12      ;#
0705 1026 01                        DB      1
0706 1027 B7 02                     DW      LINK
0707 1029 02                        DB      2
0708 102A 0C                        DB      12      ;#
0709 102B 02                        DB      2
0710 102C CF 02                     DW      TAPE
0711 102E 04                        DB      4
0712 102F 0C                        DB      12      ;#
0713 1030 04                        DB      4
0714 1031 F3 10                     DW      TTTST
0715 1033 05                        DB      5
0716 1034 0C                        DB      12      ;#
0717 1035 05                        DB      5
0718 1036 C1 12                     DW      DIAL
0719 1038 0C                        DB      6
0720 1039 02                        DB      11      ;*
0721 103A 0B                        DB      12      ;#
0722 103B FF 02                     DW      CNTRL
0723 103D 0C                        DB      12      ;#
0724 103E 05                        DB      4
0725 103F 0B                        DB      5
0726 1040 B7 12                     DW      LOCK
0727 1042 0E                        DB      2
0728 1043 0B                        DB      11      ;*
0729 1044 02                        DB      2
0730 1045 B7 12                     DW      TAP2
0731 1047 00                        DB      0
0732 1048 0B                CFNCD:  DB      12      ;#
0733 1049 02                        DB      11      ;*
0734 104A 0C                        DB      6
0735 104B 12 03                     DW      CNTRO
0736 104D 00                        DB      0
0737 104E                   ;
0738 104E                   ;
0739 104E                   ;
0740 104E 83                ID4D1:  DB      83H
0741 104F 90                        DB      90H     ;P
0742 1050 40                        DB      40H     ;E
0743 1051 80                        DB      80H     ;SP
0744 1052 70                        DB      70H     ;N
0745 1053 50                        DB      50H     ;R
0746 1054 1C                        DB      1CH     ;3
0747 1055 69                        DB      68H     ;A
0748 1056 29                        DB      28H     ;F
0749 1057 E0                        DB      0E0H    ;M
0750 1058 80                        DB      80H     ;SP
0751 1059 80                        DB      80H     ;B
0752 105A 60                        DB      60H     ;A
0753 105B 50                        DB      50H     ;R
0754 105C 8A                        DB      0A8H    ;C
0755 105D 80                        DB      80H     ;SP
0756 105E 00                        DB      0
0757 105F 80                ID4D2:  DB      80H     ;SP
0758 1060 90                        DB      90H     ;D
0759 1061 40                        DB      40H     ;E
0760 1062 80                        DB      80H     ;SP
0761 1063 70                        DB      70H     ;N
0762 1064 50                        DB      50H     ;R
0763 1065 1C                        DB      1CH     ;3
0764 1066 60                        DB      60H     ;A
0765 1067 29                        DB      28H     ;F
0766 1068 E0                        DB      0E0H    ;M
0767 1069 80                        DB      80H     ;SP
0768 106A 80                        DB      80H     ;B
0769 106B 60                        DB      60H     ;A
0770 106C 40                        DB      40H     ;L
0771 106D C3                        DB      0C3H    ;T
0772 106E 20                        DB      20H     ;I
0773 106F E0                        DB      0E0H    ;M
0774 1070 F0                        DB      0F0H    ;O
0775 1071 50                        DB      50H     ;R
0776 1072 40                        DB      40H     ;E
0777 1073 80                        DB      80H     ;SP
0778 1074 00                        DB      0
0779 1075 80                ID4D3:  DB      80H     ;SP
0780 1076 C4                        DB      0C4H    ;T
0781 1077 1C                        DB      1CH     ;3
0782 1078 80                        DB      80H     ;SP
0783 1079 90                        DB      90H     ;D
0784 107A 40                        DB      40H     ;E
0785 107B 80                        DB      80H     ;SP
0786 107C 70                        DB      70H     ;N
0787 107D 50                        DB      50H     ;R
0788 107E 1C                        DB      1CH     ;3
0789 107F 60                        DB      60H     ;A
0790 1080 29                        DB      28H     ;F
0791 1081 E0                        DB      0E0H    ;M
0792 1082 80                        DB      80H     ;SP
0793 1083 00                        DB      0
0794 1084 80                ID4D4:  DB      80H     ;SP
0795 1085 90                        DB      90H     ;D
0796 1086 40                        DB      40H     ;E
0797 1087 80                        DB      80H     ;SP
0798 1088 70                        DB      70H     ;N
0799 1089 50                        DB      50H     ;R
0800 108A 1C                        DB      1CH     ;3
0801 108B 60                        DB      60H     ;A
0802 108C 29                        DB      28H     ;F
0803 108D E0                        DB      0E0H    ;M
0804 108E 80                        DB      80H     ;SP
0805 108F 80                        DB      80H     ;B
0806 1090 60                        DB      60H     ;A
0807 1091 40                        DB      40H     ;L
0808 1092 C0                        DB      0C0H    ;T
0809 1093 F0                        DB      0F0H    ;O
0810 1094 80                        DB      80H     ;SP
0811 1095 60                        DB      60H     ;A
0812 1096 50                        DB      50H     ;R
0813 1097 8A                        DB      0A8H    ;C
0814 1098 80                        DB      80H     ;SP
0815 1099 00                        DB      0
0816 109A 80                RMSG:   DB      80H     ;SP
0817 109B 80                        DB      80H     ;SP
0818 109C 80                        DB      80H     ;SP
0819 109D 50                        DB      50H     ;R
0820 109E 80                        DB      80H     ;SP
0821 109F 00                        DB      0
0822 10A0                   ;
0823 10A0                   ;
0824 10A0                   ;
0825 10A0                   IDLD:   EQU     6
0826 10A0                   ;ID LOAD LOADS A CU ID INTO RAM
0827 10A0                   ;THIS CORRESPONDS TO ID 05
0828 10A0                   ;
0829 10A0                   ;D0 IS DIT, 1 IS DAH
0830 10A0                   ;D2 IS END CHARACTER
0831 10A0                   ;D3 IS END ID
0832 10A0                   ;
0833 10A0 21 25 30          IDLD0:  LXI     H,ID4D5
0834 10A3 06 00                     MVI     B,0
0835 10A5 0E 00                     MVI     C,0     ;ELEMENT COUNT
0836 10A7 DB 10             IDLD1:  IN      PORT1
0837 10A9 2F                        CMA
0838 10AA E6 40                     ANI     40H
0839 10AC CA A7 10                  JZ      IDLD1
0840 10AF CD 3B 02                  CALL    DEC80
0841 10B2 FE 03                     CPI     3
0842 10B4 C2 BF 10                  JNZ     IDNT0
0843 10B7 06 00                     MVI     B,0
0844 10B9 CD B2 03                  CALL    ROGER
0845 10BC C3 FC 01                  JMP     TTOH2
0846 10BF FE 02             IDNT0:  CPI     2
0847 10C1 C2 D9 10                  JNZ     IDCH
0848 10C4 78                        MOV     A,B
0849 10C5 37                        STC                     ;LEFT JUSTIFY
0850 10C6 17                IDDLY:  RAL
0851 10C7 47                        MOV     B,A
0852 10C8 0C                        INR     C
0853 10C9 3E 07                     MVI     A,7
0854 10CB B9                        CMP     C
0855 10CC DA D4 10                  JC      IDDL
0856 10CF AF                        XRA     A
0857 10D0 78                        MOV     A,B
0858 10D1 C3 C6 10                  JMP     IDDLY
0859 10D4 78                IDDL:   MOV     A,B
0860 10D5 23                        INX     H
0861 10D6 C7 A3 10                  JMP     IDLD0
0862 10D9 FE 01             IDCH:   CPI     1
0863 10DB C2 E6 10                  JNZ     IDCHD
0864 10DE 78                        MOV     A,B
0865 10DF 37                        STC
0866 10E0 17                        RAL
0867 10E1 47                        MOV     B,A
0868 10E2 0C                        INR     C
0869 10E3 C3 A7 10                  JMP     IDLD1
0870 10E6 FE 0A             IDCHD:  CPI     10
0871 10E8 C2 A7 10                  JNZ     IDLD1   ;INVALID
0872 10EB AF                        XRA     A
0873 10EC 78                        MOV     A,B
0874 10ED 17                        RAL
0875 10EE 47                        MOV     B,A
0876 10EF 0C                        INR     C
0877 10F0 C3 A7 10                  JMP     IDLD1
0878 10F3                   ;
0879 10F3                   ;
0880 10F3                   ;
0881 10F3                   TTTST:  EQU     9
0882 10F3                   ;TOUCH TONE (R) TEST ROUTINE
0883 10F3                   ;THIS FUNCTION PLACES UP TO 24 DIGITS
0884 10F3                   ;INTO A BUFFER AND REPEATS WHAT IT RECEIVED
0885 10F3                   ;IN CW AFTER CARRIER DROP
0886 10F3                   ;
0887 10F3 3e F8 30          TTTST:  LDA     OUTOK   ;ENABLED?
0888 10F6 E6 08                     ANI     8
0889 10F8 C2 FC 01                  JNZ     TTOH2   ;NO!
0890 10FB C0 89 11                  CALL    GETTT   ;GET TOUCH TONE (R)
0891 10FE 11 01 30          TTST0:  LXI     D,TYDIG+1
0892 1101 3e 00 30                  LDA     TYDIG
0893 1104 F5                        PUSH    PSW     ;SAVE IT
0894 1105 3e 00 30          TTST1:  LDA     TYDIG
0895 1108 B7                        ORA     A
0896 1109 C2 13 11                  JNZ     TTST2
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Continued on next page

tion of the number, the number of digits precedes the actual number, permitting any digit length. A 0 must be stored as a decimal 10. If the number is not found, PATCH exits. If found, the digit count is checked, primarily for the programmable number. If the number is valid, the telephone number is copied into the GETTT buffer, NOTIM is set, and control goes to PTCH3, where the rest is normal.

The remote base routine, RBASE, merely pulses RB. TAP2, the secondary tape access, jumps to the appropriate point in TAPE. DIAL, the 5#5 function, makes various checks and jumps to TTTST at a point where the existing buffer is sent.

The two ROMs are set up in a fashion to permit as many changes as possible in the second ROM without requiring a replacement of the first ROM as well. Most

```
0897 119C F1                    POP     PSW
0898 119D 32 00 30              STA     TYDIC   ;RESTORE IT
0899 11A0 C3 FC 01              JMP     TTOH2   ;DONE
0900 11A3 3D            TTOT2:  DCR     A
0901 11A4 32 00 30              STA     TYDIC
0902 11A7 D5                    PUSH    D
0903 11A8 21 B7 11              LXI     H,CWDSP ;SPACE
0904 11AB 3A F6 30              LDA     MASK
0905 11AE F5                    PUSH    PSW
0906 11AF 3E C0                 MVI     A,OCON  ;150 ONLY
0907 11B1 32 F6 30              STA     MASK
0908 11B4 CD 0B 01              CALL    CW
0909 11B7 F1                    POP     PSW
0910 11B8 32 F6 30              STA     MASK
0911 11BB D1                    POP     D
0912 11BC D5                    PUSH    D
0913 11BD 1A                    LDAX    D       ;GET DIGIT
0914 11BE 3D                    DCR     A
0915 11BF 87                    RLC             ;TIMES 2
0916 11C0 5F                    MOV     E,A
0917 11C1 16 00                 MVI     D,0
0918 11C3 21 70 11              LXI     H,DIGAD
0919 11C6 19                    DAD     D
0920 11C7 5E                    MOV     E,M
0921 11C8 23                    INX     H
0922 11C9 56                    MOV     D,M
0923 11CA EB                    XCHG            ;ADDR TO HL
0924 11CB 3A F6 30              LDA     MASK
0925 11CE F5                    PUSH    PSW
0926 11CF 3E C0                 MVI     A,OCON
0927 11D1 32 F6 30              STA     MASK
0928 11D4 CD 0B 01              CALL    CW
0929 11D7 F1                    POP     PSW
0930 11D8 32 F6 30              STA     MASK
0931 11DB D1                    POP     D
0932 11DC 13                    INX     D
0933 11DD C3 09 11              JMP     TTST1
0934 11E0               ;
0935 11E0               ;
0936 11E0               ;
0937 11E0 69 11         DIGAD:  DW      CWD1
0938 11E2 6A 11                 DW      CWD2
0939 11E4 6C 11                 DW      CWD3
0940 11E6 6E 11                 DW      CWD4
0941 11E8 70 11                 DW      CWD5
0942 11EA 72 11                 DW      CWD6
0943 11EC 74 11                 DW      CWD7
0944 11EE 76 11                 DW      CWD8
0945 11F0 78 11                 DW      CWD9
0946 11F2 7A 11                 DW      CWD0
0947 11F4 7C 11                 DW      CWDA
0948 11F6 81 11                 DW      CWDP
0949 11F8               ;
0950 11F8               ;
0951 11F8               ;
0952 11F8 7E            CWD1:   DB      7EH
0953 11F9 00                    DB      0
0954 11FA 3C            CWD2:   DB      3CH
0955 11FB 00                    DB      0
0956 11FC 1C            CWD3:   DB      1CH
0957 11FD 00                    DB      0
0958 11FE 0C            CWD4:   DB      0CH
0959 11FF 00                    DB      0
0960 1200 04            CWD5:   DB      4
0961 1201 00                    DB      0
0962 1202 84            CWD6:   DB      84H
0963 1203 00                    DB      0
0964 1204 C4            CWD7:   DB      0C4H
0965 1205 00                    DB      0
0966 1206 E4            CWD8:   DB      0E4H
0967 1207 00                    DB      0
0968 1208 F4            CWD9:   DB      0F4H
0969 1209 00                    DB      0
0970 120A FC            CWD0:   DB      0FCH
0971 120B 00                    DB      0
0972 120C 10            CWDA:   DB      10H     ;A
0973 120D C0                    DB      0C0H    ;T
0974 120E 60                    DB      60H     ;N
0975 120F 90                    DB      90H     ;M
0976 1210 00                    DB      0
0977 1211 64            CWDP:   DB      64H     ;P
0978 1212 F4                    DB      0F0H    ;O
0979 1213 30                    DB      30H     ;U
0980 1214 40                    DB      40H     ;N
0981 1215 90                    DB      90H     ;D
0982 1216 00                    DB      0
0983 1217 60            CWDSP:  DB      60H
0984 1218 00                    DB      0
0985 1219               ;
0986 1219               ;
0987 1219               ;
0988 1219               GETTT:  EQU     0
0989 1219               ;GET TOUCH TONE (R) ROUTINE
0990 1219               ;PLACES UP TO 24 DIGITS IN BUFFER
0991 1219               ;AT TYDIG+1. DIGIT COUNT AT TYDIG
0992 1219 21 00 30              LXI     D,TYDIG
0993 121C 87                    XRA     A
0994 121D 12                    STAX    D
0995 121E 13                    INX     D
0996 121F DB 10         GETT1:  IN      PORT1
0997 1221 E6 20                 ANI     20H
0998 1223 C9                    RNZ             ;CARRIER GONE
0999 1224 DB 10                 IN      PORT1
1000 1226 E6 40                 ANI     40H
1001 1228 C2 0F 11              JNZ     GETT1   ;NO TONE
1002 122B CD 38 02              CALL    DECOD
1003 122E B7                    ORA     A
1004 122F CA 0F 11              JZ      GETT1
1005 1232 12                    STAX    D       ;STORE DIGIT
1006 1233 13                    INX     D
1007 1234 3A 00 30              LDA     TYDIC
1008 1237 3C                    INR     A
1009 1238 32 0030               STA     TYDIC
1010 123B FE 18                 CPI     24
1011 123D C2 0F 11              JNZ     GETT1
1012 1240 C3 90 02              JMP     NED
1013 1243               ;
1014 1243               ;
1015 1243               ;
1016 1243               ;AUTOPATCH ROUTINE - CHECKS REQUESTED
1017 1243               ;NUMBER FOR VALIDITY. IF OK IT
1018 1243               ;BRINGS UP LINE AND REDIALS THE NUMBER
1019 1243 3A F8 30      PATCH:  LDA     OUT2R
1020 1246 E6 20                 ANI     20H
1021 1248 C2 FC 01              JNZ     TTOH2
1022 124B 3F                    XRA     A
1023 124C 32 F1 30              STA     HDTIM
1024 124F CD 69 11              CALL    GETTT   ;GET NUMBER
1025 1252 3A 00 30              LDA     TYDIC
1026 1255 B7                    ORA     A
1027 1256 C2 E6 11              JNZ     PTCH2
1028 1259 3A F8 30              LDA     OUTOR   ;DIRECT
1029 125C E6 04                 ANI     4       ;ENABLED?
1030 125E CA FC 01              JZ      TTOH2   ;NO!
1031 1261 11 F9 30              LXI     D,OUTIM
1032 1264 0E 08                 MVI     B,8
1033 1266 CD 0C 02      PTCH1:  CALL    BITS
1034 1269 D3 10                 OUT     PORT1
1035 126B CD 74 01              CALL    DELAY
1036 126E CD 10 02              CALL    BITC
1037 1271 D3 10                 OUT     PORT1
1038 1273 C3 FC 01              JMP     TTOH2
1039 1276 FE 01         PTCH2:  CPI     1
1040 1278 CA 7B 12              JZ      PTCH9
1041 127B FE 07                 CPI     7
1042 127D CA 6A 12              JZ      PTCH8
1043 1280 FE 0B                 CPI     11
1044 1282 CA FA 11              JZ      PTCH4
1045 1285 FE 0A                 CPI     A
1046 1287 C2 FC 01              JNZ     TTOH2
1047 128A 3A 01 30      PTCH4:  LDA     TYDIC+1
1048 128D FE 0A                 CPI     10      ;ZERO
1049 128F C2 FC 01              JNZ     TTOH2   ;NOT COLLECT
1050 1292 11 F9 30      PTCH3:  LXI     D,OUTIM
1051 1295 06 08                 MVI     B,8
1052 1297 CD 0C 02              CALL    BITS
1053 129A D3 10                 OUT     PORT1
1054 129C CD 74 01              CALL    DELAY
1055 129F CD 10 02              CALL    BITC
1056 12A2 D3 10                 OUT     PORT1
1057 12A4 3E 0F                 MVI     A,1B
1058 12A6 CD 74 01      PTCH5:  CALL    DELAY
1059 12A9 3D                    DCR     A
1060 12AA C2 16 12              JNZ     PTCH5   ;1 SEC WAIT
1061 12AD 11 F8 30              LXI     D,OUT2R
1062 12B0 06 40                 MVI     B,40H
1063 12B2 CD 0C 02              CALL    BITS    ;TURN LINE ON
1064 12B5 D3 30                 OUT     PORT3
1065 12B7 11 00 30              LXI     D,TYDIC
1066 12BA 1A                    LDAX    D       ;SAVE
1067 12BB F5                    PUSH    PSW     ;IT
1068 12BC 3A 00 30      PTCH6:  LDA     TYDIC
1069 12BF B7                    ORA     A
1070 12C0 CA 54 12              JZ      PTCH7
1071 12C3 CD 74 01              CALL    DELAY
1072 12C6 3D                    DCR     A
1073 12C7 32 00 30              STA     TYDIC
1074 12CA 13                    INX     D
1075 12CB 1A                    LDAX    D       ;GET DIGIT
1076 12CC 3D                    DCR     A
1077 12CD 21 06 13              LXI     H,TYTAB
1078 12D0 85                    ADD     L
1079 12D1 6F                    MOV     L,A
1080 12D2 7C                    MOV     A,H
1081 12D3 CE 00                 ACI     0
1082 12D5 67                    MOV     H,A
1083 12D6 7E                    MOV     A,M     ;TTCODE
1084 12D7 2F                    CMA
1085 12D8 D3 70                 OUT     PORT7   ;SEND TONE
1086 12DA CD 74 01              CALL    DELAY
1087 12DD 3E FF                 MVI     A,0FFH
1088 12DF D3 70                 OUT     PORT7   ;TONE OFF
1089 12E1 C3 2C 12              JMP     PTCH6   ;NEXT
1090 12E4 11 F9 30      PTCH7:  LXI     D,OUT3M
1091 12E7 06 40                 MVI     B,40H
1092 12E9 CD 10 02              CALL    BITC    ;LINE NORMAL
1093 12EC 47                    MOV     B,A
1094 12ED 3A F1 30              LDA     HDTIM
1095 12F0 B0                    ORA     B
1096 12F1 D3 30                 OUT     PORT3
1097 12F3 F1                    POP     PSW
1098 12F4 32 C0 30              STA     TYDIC   ;RESTORE IT
1099 12F7 C3 FC 01              JMP     TTOH2   ;DONE
1100 12FA 3A 01 30      PTCH8:  LDA     TYDIC+1
1101 12FD FE 01                 CPI     1
1102 12FF CA FC 01              JZ      TTOH2
1103 1302 C3 C2 12              JMP     PTCH3
1104 1305 21 3F 13      PTCH9:  LXI     H,SBTAB
1105 1308 3A 01 30              LDA     TYDIC+1
1106 130B 47                    MOV     B,A
1107 130C 7E            PCH10:  MOV     A,M
1108 130D B7                    ORA     A
1109 130E CA FC 01              JZ      TTOH2
1110 1311 B8                    CMP     B
1111 1312 CA 98 12              JZ      PCH11
1112 1315 23                    INX     H
1113 1316 23                    INX     H
1114 1317 23                    INX     H
1115 1318 C3 7C 12              JMP     PCH10
1116 131B 23            PCH11:  INX     H
1117 131C 5E                    MOV     E,M
1118 131D 23                    INX     H
1119 131E 56                    MOV     D,M
1120 131F EB                    XCHG
1121 1320 7E                    MOV     A,M
1122 1321 B7                    ORA     A
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forward references from the lower ROM go to the beginning of the second ROM, which will not change if a routine in the second ROM is modified. Frequent use is made of reading an address from a fixed location rather than reading an address directly.

The code table is organized with a three-digit code preceding the address of the program to service that code. The end of the table is marked with a 0. Naturally, the published codes are not the ones in use. The CW ID messages are set up with leading and trailing spaces to clean up the ID.

The RAM has the bottom 25 bytes reserved for the digit buffer, including one for the buffer length. 12 bytes are reserved above that for the digit #1 telephone number. Above that, space is left for the programmable ID. 22 bytes at the top are variables, and

```
1193 1292 CA FC 01          JZ      TTOH2
1194 1295 FE 0C             CPI     12
1195 1297 D2 FC 01          JNC     TTOH2
1196 129A 11 00 30          LXI     D,TTDIG
1197 129D 46                MOV     B,M
1198 129E 04                INR     B
1199 129F 7E          PCH12:MOV     A,M
1200 12A0 12                STAX    D
1201 12A1 23                INX     H
1202 12A2 13                INX     D
1203 12A3 05                DCR     B
1204 12A4 C2 9F 12          JNZ     PCH12
1205 12A7 3E 20             MVI     A,20H   ;DISABLE
1206 12A9 32 F1 30          STA     MOTIM   ;TIMER
1207 12AC C7 02 12          JMP     PTCH3
1208 12AF                   ;
1209 12AF                   ;
1210 12AF                   ;
1211 12AF                   ;REMOTE BASE CONNECTS RPT TO PHONE LINE
1212 12AF                   ;BUT DOES NOT SEIZE THE LINE
1213 12AF 11 F9 30    RBASE:LXI     D,OUTSW
1214 12B2 0E 04             MVI     B,4
1215 12B4 C3 D6 11          JMP     PTCH1
1216 12B7                   ;
1217 12B7                   ;
1218 12B7                   ;
1219 12B7 3A F8 30    TAP2:LDA      OUTOM   ;TAPE ACCESS
1220 12BA B7                ORA     A       ;VIA CONTROL
1221 12BB FA FC 01          JM      TTOH2   ;STATION
1222 12BE C3 D7 02          JMP     TAP1
1223 12C1                   ;
1224 12C1                   ;
1225 12C1                   ;
1226 12C1                   ;DIAL SENDS IN CW WHATEVER WAS LAST
1227 12C1                   ;ENTERED VIA THE TTY ROUTINE
1228 12C1                   ;OR THE AUTOPATCH
1229 12C1 3A F8 30    DIAL: LDA      OUTOM   ;WHAT DID I DIAL?
1230 12C4 E6 10             ANI     10H     ;ENABLED?
1231 12C6 C2 FC 01          JNZ     TTOH2   ;NO
1232 12C9 3A 0D 30          LDA     TTDIG
1233 12CC FE 19             CPI     25      ;VALID?
1234 12CE D2 FC 01          JNC     TTOH2   ;NO
1235 12D1 CD 90 02          CALL    VCD
1236 12D4 C3 FE 10          JMP     TTOTO
1237 12D7                   ;
1238 12D7                   ;
1239 12D7                   ;
1240 12D7                   ;LOCK PERMITS A LOCKOUT OF CONTROL
1241 12D7                   ;AND DISABLING OF THE ROGER ROUTINE
1242 12D7                   ;LOCK WAITS FOR 3 DIGITS:
1243 12D7                   ;THE SECOND ELIMINATES (1) OR CLEARS (0)
1244 12D7                   ;THE ROGER ROUTINE.
1245 12D7                   ;THE THIRD LOCKS OR UNLOCKS ENTRY
1246 12D7                   ;TO THE CONTROL MODE
1247 12D7 CD 19 02    LOCK: CALL    LOAD
1248 12DA E 01              MVI     A,1
1249 12DC B8                CMP     E
1250 12DD C2 E3 12          JNZ     LOCK3
1251 12E0 C3 EA 12          JMP     LOCK4
1252 12E3 3E 0A       LOCK3:MVI     A,10
1253 12E5 B8                CMP     E
1254 12E6 C2 ED 12          JNZ     LOCK5
1255 12E9 AF                XRA     A
1256 12EA 32 F7 30    LOCK4:STA     LKROG
1257 12ED 3E 01       LOCK5:MVI     A,1
1258 12EF B8                CMP     B
1259 12F0 C2 F6 12          JNZ     LOCK1
1260 12F3 C3 FD 12          JMP     LOCK2
1261 12F6 3E 0A       LOCK1:MVI     A,10
1262 12F8 B8                CMP     B
1263 12F9 C2 FC 01          JNZ     TTOH2   ;INVALID
1264 12FC AF                XRA     A
1265 12FD 32 F2 30    LOCK2:STA     LCKR
1266 1300 CD D2 03          CALL    ROGER
1267 1303 C3 FC 01          JMP     TTOH2
1268 1306                   ;
1269 1306                   ;
1270 1306                   ;
1271 1306                   ;TABLE FOR REGENERATING TOUCH TONES (R)
1272 1306 80          TTTAB:DB      80H     ;1
1273 1307 84                DB      84H     ;2
1274 1308 82                DB      82H     ;3
1275 1309 40                DB      48H     ;4
1276 130A 44                DB      44H     ;5
1277 130B 42                DB      42H     ;6
1278 130C 28                DB      28H     ;7
1279 130D 24                DB      24H     ;8
1280 130E 22                DB      22H     ;9
1281 130F 14                DB      14H     ;0
1282 1310 18                DB      18H     ;*
1283 1311 12                DB      12H     ;#
1284 1312                   ;
1285 1312                   ;
1286 1312                   ;
1287 1312                   ;LOAD NUMBER FOR SINGLE DIGIT #1
1288 1312 21 19 30    LNUM: LXI     H,NUMBR
1289 1315 3E 00             MVI     A,0
1290 1317 D5 10       LNUM1:IN      PORT1
1291 1319 2F                CMA
1292 131A E6 40             ANI     40H
1293 131C CA 17 13          JZ      LNUM1
1294 131F CD 3B 02          CALL    DECOD
1295 1322 FE 0B             CPI     11      ;*
1296 1324 C2 2D 13          JNZ     LNUM2
1297 1327 CD D2 03          CALL    ROGER
1298 132A C3 FC 01          JMP     TTOH2
1299 132D 47          LNUM2:MOV     B,A
1300 132E 3A 19 30          LDA     NUMBR
1301 1331 FE 0B             CPI     11      ;MAX DIGITS
1302 1333 CA 17 13          JZ      LNUM1
1303 1336 3C                INR     A
1304 1337 32 19 30          STA     NUMBR
1305 133A 23                INX     H
1306 133B 70                MOV     M,B
1307 133C C3 17 13          JMP     LNUM1
1308 133F                   ;
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1309 133F                   ;
1310 133F                   ;
1311 133F 01          SDTAB:DB      1
1312 1340 19 30             DW      NUMBR   ;#1
1313 1342 02                DB      2
1314 1343 58 13             DW      TNUM2
1315 1345 03                DB      3
1316 1346 63 13             DW      TNUM3
1317 1348 04                DB      4
1318 1349 68 13             DW      TNUM4
1319 134B 05                DB      5
1320 134C 73 13             DW      TNUM5
1321 134E 06                DB      6
1322 134F 78 13             DW      TNUM6
1323 1351 07                DB      7
1324 1352 83 13             DW      TNUM7
1325 1354 08                DB      8
1326 1355 88 13             DW      TNUM8
1327 1357 09                DB      9
1328 1358 93 13             DW      TNUM9
1329 135A 00                DB      0
1330 135B                   ;
1331 135B 07          TNUM2:DB      7       ;BALTO CITY
1332 135C 02                DB      2
1333 135D 02                DB      2
1334 135E 02                DB      2
1335 135F 03                DB      3
1336 1360 03                DB      3
1337 1361 03                DB      3
1338 1362 03                DB      3
1339 1363 07          TNUM3:DB      7       ;TRANSIT & TPC
1340 1364 03                DB      3
1341 1365 09                DB      9
1342 1366 06                DB      6
1343 1367 03                DB      3
1344 1368 0A                DB      10
1345 1369 05                DB      5
1346 136A 0A                DB      10
1347 136B 07          TNUM4:DB      7       ;MD STATE POL
1348 136C 04                DB      4
1349 136D 08                DB      8
1350 136E 06                DB      6
1351 136F 03                DB      3
1352 1370 01                DB      1
1353 1371 0A                DB      10
1354 1372 01                DB      1
1355 1373 07          TNUM5:DB      7       ;HARBOR TUNNEL
1356 1374 03                DB      3
1357 1375 05                DB      5
1358 1376 05                DB      5
1359 1377 03                DB      3
1360 1378 05                DB      5
1361 1379 0A                DB      10
1362 137A 0A                DB      10
1363 137B 07          TNUM6:DB      7       ;ANNE ARUNDEL
1364 137C 09                DB      9
1365 137D 08                DB      8
1366 137E 07                DB      7
1367 137F 04                DB      4
1368 1380 0A                DB      10
1369 1381 05                DB      5
1370 1382 0A                DB      10
1371 1383 07          TNUM7:DB      7       ;COAST GUARD
1372 1384 07                DB      7
1373 1385 08                DB      8
1374 1386 09                DB      9
1375 1387 08                DB      8
1376 1388 0A                DB      10
1377 1389 05                DB      5
1378 138A 0A                DB      10
1379 138B 07          TNUM8:DB      7       ;BALTO CO
1380 138C 04                DB      4
1381 138D 09                DB      9
1382 138E 04                DB      4
1383 138F 02                DB      2
1384 1390 01                DB      1
1385 1391 01                DB      1
1386 1392 01                DB      1
1387 1393 07          TNUM9:DB      7       ;HOWARD CO
1388 1394 04                DB      4
1389 1395 06                DB      6
1390 1396 05                DB      5
1391 1397 01                DB      1
1392 1398 06                DB      6
1393 1399 01                DB      1
1394 139A 01                DB      1
1395 139B                   ;
1396 139B                   ;
1397 139B                   ;
1398 139B             ORG     3080H   ;RAM BUFFER
1399 3080                   ;
1400 3080             TTDIG:  EQU     $
1401 3080                     DS      25      ;SPACE FOR DIGITS
1402 3019             NUMBR:  DS      13      ;TEL #1
1403 3025             IDADS:  EQU     $
1404 3025                     DS      157     ;SPACE FOR STACK. IN #3
1405 30EA             STACK:  EQU     $
1406 30EA             OUTR1:  DS      1
1407 30EB             OUTR2:  DS      1
1408 30EC             OUTR3:  DS      1
1409 30ED             TIMER:  DS      1
1410 30F1             MOTIM:  DS      1
1411 30F2             LCKR:   DS      1
1412 30F3             IBM1:   DS      1
1413 30F4             IBM2:   DS      1
1414 30F5             TIME:   DS      1
1415 30F6             MASK:   DS      1
1416 30F7             LKROG:  DS      1
1417 30F8             OUTOM:  DS      1
1418 30F9             OUT1M:  DS      1
1419 30FA             OUT2M:  DS      1
1420 30FB             OUT3M:  DS      1
1421 30FC             OUT4M:  DS      1
1422 30FD             OUT5M:  DS      1
1423 30FE             OUT6M:  DS      1
1424 30FF             OUT7M:  DS      1
```

the stack starts below them. The stack works down, and the programmable ID works up. No safeguards are set up to eliminate the two clashing. The amount of space is so large for the required functions that for even the longest imaginable ID message there will be plenty of room left for the stack. I do not suggest testing the system by loading an ID of 197 characters! Up to 150 should be safe. OUT0M is a dummy output port. Although it is set up as an output port, there is no physical port. This is convenient for both programming and operation.

Design Philosophy

As previously mentioned, several years ago I had constructed a microprocessor system to perform a similar

function. At that time, I built the hardware first. After completing this project, I have no doubt that the proper procedure is the other way around. A general idea of the hardware should be in mind, but the program should be written first. Writing the program defines the parameters of the system. By doing so, I found that some hardware modifications were needed that otherwise I would have had to go back and redo.

The program was written and debugged on the development system described. I configured the I/O ports so that the program could be executed on my large system. The program was in operation on it before a single wire was cut to construct the hardware. Clip leads and external oscillators were used to test the system. Did you ever try to simulate touchtones with clip leads, trying not to be caught by a three-second timer?

The program was modularized as much as possible. If any routine is longer than about two or three pages, it is too long and should be broken down into smaller routines. Not only is it easier to write that way, but it is also easier to understand how it works a few months later. For routines with many conditionals, flowcharts are a must. Originally, a skeleton program was written—just enough so that the entire program was self-consistent. Gradually the individual routines can be added to the code table and debugged. The throughput using these techniques can be quite high. I wrote the skeleton program in one day, and debugged it the next. Once an operational program was ready, the hardware was constructed. In the week or so it took to build the thing, the program was beefed up. By the time the hardware was ready, the software was refined. I cannot overemphasize the fact that a 100% operational program is necessary before building the hardware. When the ROMs are plugged in, if the program is in any doubt, and the system does not work, you do not know if the problem is hardware or software, resulting in an exercise in futility.

The hardware/software tradeoffs previously mentioned are important. A lot of thought is necessary before plunging ahead with design. The total software and hardware development time/cost must be considered. Even though the individual pays nothing for his own software, thinking like the businessman who must pay for his software will give a more balanced design.

When building hardware, it is advantageous to freely add LEDs on signal lines. You may not need them after the circuitry is in operation, but they are invaluable when debugging and testing the system. Design a system that not only works properly, but also can be made to operate properly in a reasonable amount of time.

Fault tolerance is an area at the frontier of theoretical knowledge. The discipline is about a decade old, and much remains to be worked out satisfactorily. Semiconductor technology is increasing at a rate which is hard to keep up with. Writing programs which merely function, and programs which both function and are error-tolerant, are two different things. Instead of making equivalence tests, it is better to make relational tests. Otherwise, if an error occurs, a test may fall through. Subprograms are usually expected to be entered with certain initial conditions. They should be constructed so that if those conditions are erroneous, the subprogram will exit soon. The worst thing that can happen is an erroneous input condition resulting in an endless loop. In a controller, it may not be as easy to push the reset button when something goes awry as it is on a general-purpose computer. I certainly did not follow all of these tenets in writing the software; however, I attempted to keep them in mind as much as possible.

The original program, somehow, did manage to crash twice. After that, I added the error recovery portion. It is a very simple, first-order attack, but it covers more errors than a first glance shows. If the program gets into a false state, it will often go to a faulty address. Since the hardware uses a small amount of the address space, it is quite likely that the program will be sent to

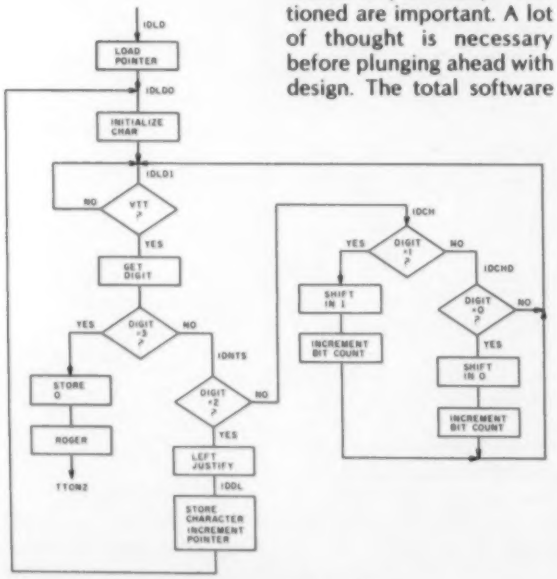

Fig. 8. ID load routine.

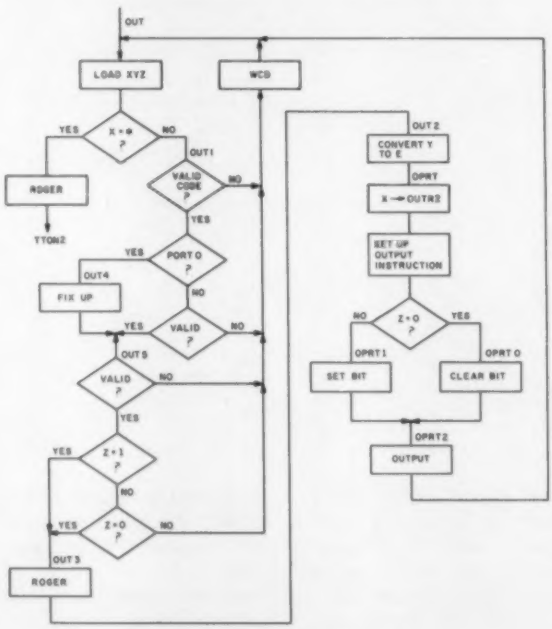

Fig. 9. Out routine.

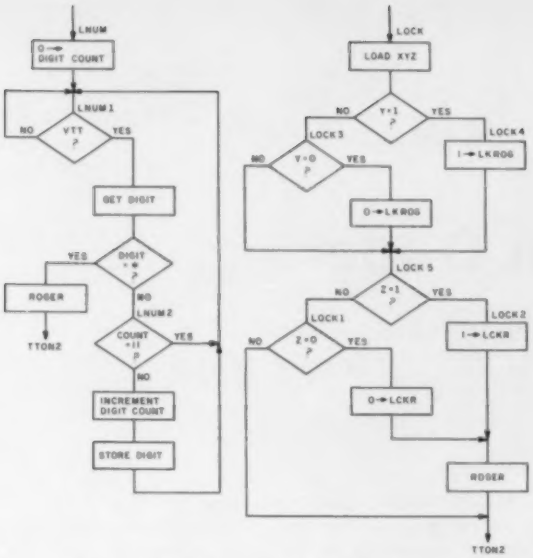

Fig. 10. Load number and lock routines.

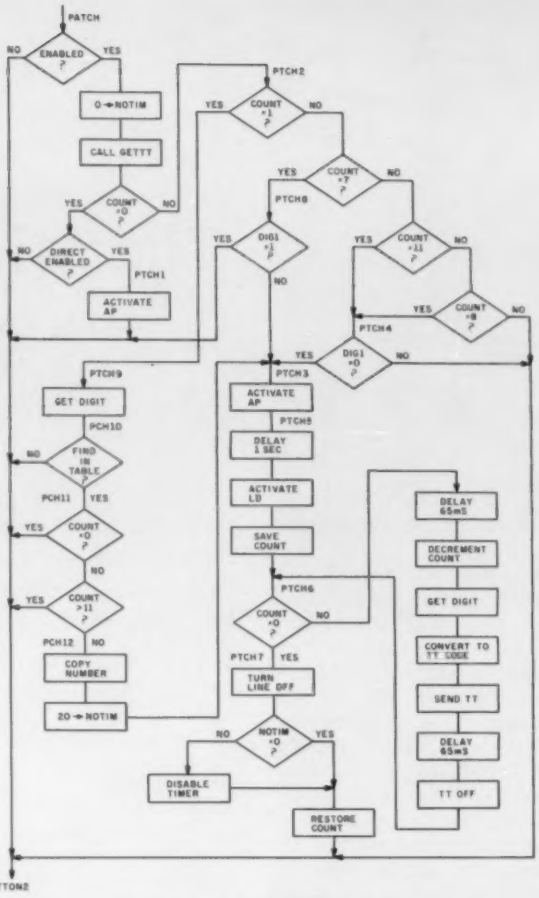

Fig. 11. Autopatch routine.

a place where there is no memory. This results in reading all highs; the instruction FF is the interrupt instruction, so effectively an invalid memory address interrupts the program. That is why I placed the recovery routine at the interrupt location. The processor is not being interrupted, but it interprets the error as an interrupt. A second different thing about the fault-tolerant program is that the enable interrupt instruction was placed into the master loop. Otherwise, if the interrupt were ever disabled when in the foreground program, there would be no way to communicate with it.

I am not claiming that the system is totally fault-tolerant, but by the addition of some very simple checks, the fault tolerance can be increased tremendously. This entire project has been a good education.

Expansion

There are many additions and improvements which can be made. The advantage of the whole arrangement is that for many changes, hardware need not be touched. Many functions can be added by software changes only. It is more pleasant to sit in an easy chair at home rewriting the program than to sit on the cold, hard floor at the repeater site to effect changes. If changes don't work, all that has to be done is to put the original ROMs back in.

Additional hardware can be added to mate with the existing circuitry, and it is not necessary to worry about the additional control functions, as plenty of spares are already provided. A possible improvement to the software would allow interrogation of the status bits. This is a simple addition which is not required but might be useful. A planned hardware addition to the system will provide downlink telemetry from the site. Lights on the voting selector indicate which receivers are being accessed, and which receiver the voter selects. The telemetry will transmit the voter lights in real-time. Incorporated in the telemetry package will be an analog-to-digital converter. Upon command from the control system, the telemetry will switch from the voter lights to meter readings read by the A/D; plate voltage, plate and grid current for each repeater, and cabinet temperature could be read. With the existing central control system, the possibilities for expansion are straightforward and exciting.

Acknowledgements

I would like to thank Carroll Van Ness K3HZU for his able assistance in designing the autopatch circuitry. Until this time, Carroll has been the father of the control circuitry and the autopatch. His equipment always functioned fine, but there is only so much that can be done with relays. Carroll is now a microcomputer convert.

I received help from Vern Chapin K3VC with the metalwork. Despite broken saw blades and bruised fingers, he finished the panels.

I thank Frank Ayd WA3ILR, who stayed with me over 13 hours at the site on the day of installation. We were both dirty, tired, cold, and hungry, but he remained with me while making frantic pleas that we quit.

Thanks go again to Vern Chapin K3VC, and also to Marc Leavey, M.D., WA3AJR, for their photography.

And if not for Jack Biggs K3SP and Larry D'Anna WA3KOK, with the assistance of many others over a period of several years, I would not have had the excellent repeater for which to develop the control system.■

Jozef Boniakowski WB2MIC
714 Fletcher Dr.
Neptune NJ 07753
Program by
Bill Summers WA2RZR

The Micro Duper

— for small contests

The January VHF Sweepstakes is a very popular contest. It brings out operation on the VHF frequencies that usually does not exist at other times. In fact, anyone with a modest setup capable of 100 Watts on CW and SSB with a beam of 11 elements or better can make hundreds of contacts during this weekend on one band alone. Since I am equipped with just a TS-700A and 16 elements at 50 feet, I decided to try my luck on two meters.

A few glasses of wine later, my wife, Chris WA2KOU, and Bill WA2RZR became more interested in coming up with a computer dupe sheet for the contest than operating the contest itself. The computer system is the Heath H8/H9. The program calls for the operator to enter the call of the station. The computer will then ask if you have entered the call correctly in order to prevent typing mistakes. Upon answering with a "Y" for "yes," the computer will then ask if you wish to have the station logged into memory. This was placed into the program to allow the contest operator the opportunity to work (or try to work) that particular station. If you work that station and answer "Y" to the last computer question, the program logs that call and returns to the beginning.

If you answer "N" for "no" to the computer question "Do you have the call correct?", the computer will return again to the begnning and ask for another call to check.

In the event that you enter a call that has already been worked and logged, the computer will respond with "DUPE - DUPE - DUPE - DUPE - DUPE" or any other obscenity you wish to include and then return with a question for the next call. A sample of the program is shown in Fig. 1.

As can be seen, Fig. 1 is a rather simple program and can be expanded to include such things as different bands, etc. But the main purpose was to have an easy dupe sheet for the minimum amount of time and energy, and the maximum amount of glasses of wine. It works well, and it does not take much time to run in between contacts. If you make it too complex, it may take time away from hunting down the points. The program listing for this little gem is shown in Fig. 2. Good luck, and I'd like to hear about any changes. ■

```
DUPE SEARCH FOR CALL? ------- WB3MIC
DO YOU HAVE CALL CORRECT ------- N
DUPE SEARCH FOR CALL ? ------- WB2MIC
DO YOU HAVE CALL CORRECT ------- Y
STATION NOT WORKED - CALL IT -------
SHOULD STATION BE LOGGED ? ------- Y
DUPE SEARCH FOR CALL ? ------- WB2MIC
DO YOU HAVE CALL CORRECT ? ------- Y
DUPE - DUPE - DUPE - DUPE - DUPE - DUPE - DUPE
DUPE SEARCH FOR CALL ? -------
```

Fig. 1. Sample run.

```
10 REM VHF S/S LOG WB2MIC and WA2RZR
15 DIM C$(250)
20 PRINT :PRINT :LINE INPUT "DUPE SHEET FOR CALL ? ------- ";A$
30 LINE INPUT "DO YOU HAVE CALL CORRECT ? ------- ";B$
40 IF B$ = "Y" THEN GOTO 60
50 GOTO 20
60 LET X = 0
70 X = X + 1
80 IF C$(X) = "" THEN GOTO 150
90 IF C$(X) = A$ THEN GOTO 200
100 GOTO 70
150 PRINT :PRINT "STATION NOT WORKED - CALL IT ------ "
160 LINE INPUT "SHOULD STATION BE LOGGED ? ------- ";B$
170 IF B$ = "Y" THEN GOTO 190
180 GOTO 20
190 LET C$(X) = A$
195 GOTO 20
200 PRINT "DUPE - DUPE - DUPE - DUPE - DUPE - DUPE - DUPE"
210 GOTO 20
```

Fig. 2. Program listing. Please note that, in statement 15, the number of contacts that the program will keep track of is 250, but can be changed by altering the number within the parentheses.

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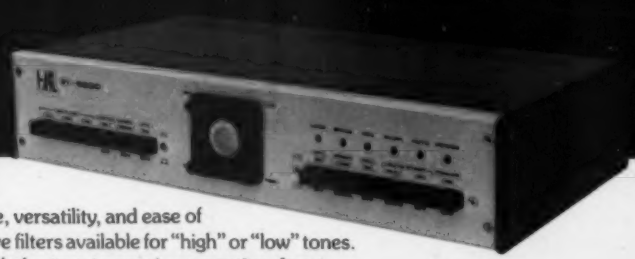

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An 8080 Disassembler

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This program was written for a Poly-88 microcomputer. However, since it is in BASIC, it is easily modified for other 8080-based computers that have a BASIC interpreter or compiler available.

A disassembler's task is very difficult. It must be able to jump into the middle of the computer's memory, help the user to read the mixture of ASCII and numerical data stored there, and change the numerical instruction codes into mnemonic assembler code. Instructions on the 8080 are of variable length, and if the disassembler happens to start in the middle of an instruction rather than at its beginning, what comes out is garbage.

To help cure these problems, this disassembler displays the contents of each location in hexadecimal, in ASCII, and in assembler code. It takes into account the variable length of the instructions. The misalignment problem is quite difficult, and if the disassembler is started in the middle of an instruction, it usually takes a few instructions before it is back on the track. However, this program incorporates a heuristic method for obtaining correct alignment. A special code "P", for "Previous instruction," attempts to find the nearest previous instruction that seems reasonable. What it actually does is this: first it jumps back in memory twelve bytes, then it disassembles its way forward to the last instruction that does not overlap the one you started in. The odds are very good that, during this process, the disassembler will find the proper alignment. This feature is, perhaps, the most interesting advance this disassembler exhibits. The other features that make it very convenient to use are explained in the operating instructions.

The disassembler was written by Douglas Wyatt, with a little bit of the code (and probably most of the bugs) supplied by me. A few comments on changing Poly BASIC to your BASIC might help. The exclamation point (!) means "PRINT." Anything shown in lowercase may be changed to uppercase. We think that it is nicer for the computer to talk in standard English if it can, so we use lowercase where appropriate. The function INP(1) grabs a character from the keyboard. Thus, lines 110 and 120 take a character, C, and ask if it is a RETURN (ASCII-13). If it is, the computer does a RETURN and a LINE FEED. The slash (/) allows two instructions to appear on the same line. You can modify this so that they are on separate lines if your BASIC doesn't support this feature.

Knowing the symbol equivalent of various ASCII codes is useful in understanding the program. Your BASIC must have the PEEK function, of course. On some, this is called EXAM. We also use TAB. If you don't have the multiway branch (the ON instruction) you will have to use a list of IFs. It's not all that hard.

Operating Instructions

When the program is running, a press on the space bar disassembles the next instruction. Any key

Program listing.

```
90 GOSUB 9000\REM INITIALIZE
100 !"*",
110 C=INP(1)
120 IF C=13 THEN !\GOTO 100
130 IF (C<32) OR (C>122) THEN 110
140 GOSUB 200
145 GOSUB 1000
150 GOTO 100
200 IF C>96 THEN C=C-32\REM MAKE UPPER-CASE
205 C$=CHR$(C)
210 IF C$=" " THEN RETURN
220 IF C$="A" THEN 2000
230 IF C$="J" THEN 400
240 IF C$="B" THEN 500
250 IF C$="C" THEN 450
260 IF C$="R" THEN 600
270 IF C$="P" THEN 700
300 A=A0
310 RETURN
400 IF J0=0 THEN 300
410 !"Jump",
420 A=E
430 RETURN
450 IF J0=0 THEN 300
460 !"Call",
465 S(S0)=A
470 S0=S0+1
475 A=E
480 RETURN
500 !"Back"
510 A=A0-1
520 RETURN
600 IF S0=0 THEN 300
610 !"Return",
620 S0=S0-1
630 A=S(S0)
640 RETURN
700 !"Previous instr."
710 T=A0-12
720 A=T\GOSUB 1200
730 I=B(PEEK(A))
740 T=T+I
750 IF T<A0 THEN 720
760 RETURN
1000 !\REM MAIN LOOP
1005 GOSUB 1200
1010 H2=A\GOSUB 4000\REM PRINT ADDRESS
1020 !":",TAB(T1),
1025 A0=A\REM REMEMBER ADDRESS
1030 X=PEEK(A)
1040 FOR I=0 TO B(X)-1
1050 H=PEEK(A+I)
1055 GOSUB 4200
1060 NEXT I
1065 !TAB(T2),
1070 FOR I=0 TO B(X)-1
1075 H=PEEK(A+I)
1080 IF(H<32)OR(H>126) THEN !"_", ELSE !CHR$(H),
1085 NEXT I
1090 !TAB(T3),
1100 GOSUB 5000\REM DISASSEMBLE INSTRUCTION
1110 !TAB(T4),
1120 RETURN
1195 REM NORMALIZE A
1200 IF A<0 THEN A=A+W\GOTO 1200
1210 IF A<W THEN RETURN
1220 A=A-W*INT(A/W)
1230 RETURN
2000 !"Address: "
2010 GOSUB 2200
2020 A=H2
2030 RETURN
2195 REM GET A HEX NUMBER FROM THE KEYBOARD
2200 H2=0
2210 I=0
2220 C=INP(1)
2225 C$=CHR$(C)
2230 C=C-48\REM ASCII 0
2240 IF C<0 THEN 2220
2250 IF C<10 THEN 2300
2260 C=C-7\REM MAGIC!
2270 IF (C<10)OR(C>15) THEN 2220
2300 !C$,
2310 I=I+1
2320 H2=16*H2+C
2330 GOTO 2220
2350 IF I=0 THEN 2220
2360 I=I-1
2370 H2=INT(H2/16)
2380 !CHR$(127),
2390 GOTO 2220
2400 IF I=0 THEN !"0",
2410 RETURN
3995 REM PRINT H2 AS 4 HEX DIGITS
4000 H=INT(H2/256)
4010 GOSUB 4200
4020 H=H2-256*H
4030 GOTO 4200
4195 REM PRINT H AS 2 HEX DIGITS
4200 N=INT(H/16)
4210 !H$(N+1,N+1),
4220 N=H-16*N
4230 !H$(N+1,N+1),
4240 RETURN
5000 REM GIVEN ADDRESS IN A, DISASSEMBLE 1 INSTRUCTION
5005 J0=0\REM ZERO JUMP FLAG
5010 X=PEEK(A)\REM OPCODE IN X
5015 A=A+1
5020 L=INT(X/64)\REM BITS 6-7
5030 ON L+1 GOTO 5100,7000,6000,8000
5100 REM 00XXXXXX
5120 ON J+1 GOTO 5130,5200,5400,5600,5700,5710,5800,5900
5130 IF X>0 THEN 7200
5140 !"NOP",
5150 RETURN
5200 REM 00XXX001
5210 J=INT(I/2)\REM BITS 4-5
5215 K=I-2*J\REM BIT 3
5220 IF K=0 THEN 5300
5230 !"DAD",
5240 GOTO 6600
5300 !"LXI"
5310 GOSUB 6600
5320 !",",
5330 GOTO 7500
5400 REM 00XXX010
5410 K=INT(I/4)\REM BIT 5
5420 I=I-4*K\REM BITS 3-4
5430 IF K=1 THEN 5500
5440 J=INT(I/2)\REM BIT 4
5450 K=I-2*J\REM BIT 3
5460 ON K+1 GOTO 5470,5480
5470 !"STAX",\GOTO 6600
5480 !"LDAX",\GOTO 6600
5500 ON I+1 GOTO 5510,5520,5530,5540
5510 !"SHLD",\GOTO 7450
5520 !"LHLD",\GOTO 7450
5530 !"STA",\GOTO 7450
5540 !"LDA",\GOTO 7450
5600 REM 00XXX011
5610 J=INT(I/2)\REM BITS 4-5
5620 K=I-2*J\REM BIT 3
5630 ON K+1 GOTO 5640,5650
5640 !"INX",\GOTO 6600
5650 !"DCX",\GOTO 6600
5700 !"INR",\J=I\GOTO 6400
5710 !"DCR",\J=I\GOTO 6400
5800 REM 00XXX110
5810 !"MVI",
5815 J=I
5820 GOSUB 6400
5830 !",",
5840 GOTO 7700
5900 REM 00XXX111
5910 ON I+1 GOTO 5920,5930,5940,5950,5960,5970,5980,5990
5920 !"RLC",\RETURN
5930 !"RRC",\RETURN
5940 !"RAL",\RETURN
5950 !"RAR",\RETURN
5960 !"DAA",\RETURN
5970 !"CMA" \RETURN
5980 !"STC",\RETURN
5990 !"CMC",\RETURN
6000 REM 10XXXXXX
6030 ON I+1 GOTO 6100,6110,6120,6130,6140,6150,6160,6170
6100 !"ADD",\GOTO 6200
6110 !"ADC",\GOTO 6200
6120 !"SUB",\GOTO 6200
6130 !"SBB",\GOTO 6200
6140 !"ANA",\GOTO 6200
6150 !"XRA",\GOTO 6200
6160 !"ORA",\GOTO 6200
6170 !"CMP",\GOTO 6200
6200 !" ",
6210 GOTO 6500
6400 REM PRINT BLANK, THEN REG. NAME
6410 !" ",
6500 REM GIVEN J, PRINT REGISTER NAME
6510 N=J+1
6520 !R$(N,N),
6530 RETURN
6600 !" ",
6700 REM GIVEN J, PRINT RP NAME
6710 N=J+1
6720 C$=D$(N,N)
6730 !C$,
6740 IF C$="S" THEN !"P",
6750 RETURN
7000 REM 01XXXXXX
7010 IF X=118 THEN !"HLT",\RETURN
7020 !"MOV ",
7040 K=J\REM SAVE J
7050 J=I\GOSUB 6500
7060 !",",
7070 J=K\GOSUB 6500
```

```
7080 RETURN
7200 REM UNDEFINED INSTRUCTION
7210 !"--",
7220 RETURN
7400 REM JUMP OR CALL
7410 REM SET JUMP FLAG
7420 J0=1
7430 !" ",
7500 REM FETCH NEXT 2 BYTES, INTERPRET AS ADDRESS,
7510 REM AND PRINT IN HEX
7520 Y=PEEK(A)\A=A+1
7530 Z=PEEK(A)\A=A+1
7540 E=Y+256*Z\REM E IS EFFECTIVE ADDRESS
7550 H=Z\GOSUB 4200
7560 H=Y\GOSUB 4200
7570 RETURN
7700 REM FETCH AND PRINT NEXT BYTE
7710 Y=PEEK(A)\A=A+1
7720 H=Y
7730 GOTO 4200
7800 REM PRINT RST ADDRESS
7810 ! I,
7820 RETURN
8000 REM 11XXXXXX
8040 ON J+1 GOTO 8050,8100,8200,8300,8400,8500,8600,8700
8050 !"R",\REM RETURN ON CONDITION
8060 GOTO 8800
8100 REM 11XXX001
8105 J=INT(I/2)\REM BITS 4-5
8110 K=I-2*J\REM BIT 3
8115 IF K=1 THEN 8150
8120 !"POP ",
8130 GOTO 8900
8150 ON J+1 GOTO 8160,7200,8170,8180
8160 !"RET",\RETURN
8170 !"PCHL",\RETURN
8180 !"SPHL",\RETURN
8200 REM 11XXX010
8210 !"J",\REM JUMP ON CONDITION
8220 GOSUB 8800
8230 GOTO 7400
8300 REM 11XXX011
8310 ON I+1 GOTO 8320,7200,8330,8340,8350,8360,8370,8380
8320 !"JMP",\GOTO 7400
8330 !"OUT ",\GOTO 7700
8340 !"IN ",\GOTO 7700
8350 !"XTHL",\RETURN
8360 !"XCHG",\RETURN
8370 !"DI",\RETURN
8380 !"EI",\RETURN
8400 REM 11XXX100
8410 !"C",\REM CALL ON CONDITION
8420 GOSUB 8800
8430 GOTO 7400
8500 REM 11XXX101
8510 J=INT(I/2)\REM BITS 4-5
8520 K=I-2*J\REM BIT 3
8530 IF K=1 THEN 8550
8540 !"PUSH ",\GOTO 8900
8550 ON J+1 GOTO 8560,7200,7200,7200
8560 !"CALL",
8570 GOTO 7400
8600 REM 11XXX110
8605 ON I+1 GOTO 8610,8615,8620,8625,8630,8635,8640,8645
8610 !"AD",\GOTO 8650
8615 !"AC",\GOTO 8650
8620 !"SU",\GOTO 8650
8625 !"SB",\GOTO 8650
8630 !"AN",\GOTO 8650
8635 !"XR",\GOTO 8650
8640 !"OR",\GOTO 8650
8645 !"CP",
8650 !"I ",
8660 GOTO 7700
8700 REM 11XXX111
8710 !"RST",
8720 H=I\GOSUB 7800
8730 RETURN
8800 REM GIVEN I, PRINT RET, CALL, OR JMP CONDITION
8810 ON I+1 GOTO 8820,8830,8840,8850,8860,8870,8880,8890
8820 !"NZ",\RETURN
8830 !"Z",\RETURN
8840 !"NC",\RETURN
8850 !"C",\RETURN
8860 !"PO",\RETURN
8870 !"PE",\RETURN
8880 !"P",\RETURN
8890 !"M",\RETURN
8900 REM GIVEN J, PRINT RP NAME FOR PUSH OR POP
8910 I=J+1
8920 C$=D$(I,I)
8930 IF C$="S" THEN !"PSW",\RETURN
8940 !C$,\RETURN
9000 REM INITIALIZATION
9010 DIM R$(8)
9020 R$="BCDEHLMA"\REM REGISTER NAMES
9030 DIM D$(4)
9040 D$="BDHS"\REM REGISTER PAIR NAMES
9050 DIM H$(16)
9060 H$="0123456789ABCDEF"
9100 DIM B(255)\REM # OF BYTES FOR INSTRUCTION
9105 FOR I=0 TO 63
9110 READ B(I)
9115 NEXT I
9120 FOR I=64 TO 191
9125 B(I)=1
9130 NEXT I
9135 FOR I=192 TO 255
9140 READ B(I)
9145 NEXT I
9150 DATA 1,3,1,1,1,1,2,1,1,1,1,1,1,1,2,1
9160 DATA 1,3,1,1,1,1,2,1,1,1,1,1,1,1,2,1
9170 DATA 1,3,3,1,1,1,2,1,1,1,3,1,1,1,2,1
9180 DATA 1,3,3,1,1,1,2,1,1,1,3,1,1,1,2,1
9200 DATA 1,1,3,3,3,1,2,1,1,1,3,1,3,3,2,1
9210 DATA 1,1,3,2,3,1,2,1,1,1,3,2,3,1,2,1
9220 DATA 1,1,3,1,3,1,2,1,1,1,3,1,3,1,2,1
9230 DATA 1,1,3,1,3,1,2,1,1,1,3,1,3,1,2,1
9300 A=0
9305 A0=0
9310 J0=0
9350 W=65536
9400 REM TAB STOPS
9410 T1=7
9420 T2=15
9430 T3=24
9440 T4=40
9500 DIM S(20)\REM ADDRESS STACK
9510 S0=0
9900 RETURN
```

other than a command just repeats the previous instruction. The following six commands form the entire assembler. When they are pressed, no RETURN is required if you use the INP function or its equivalent.

A(ddress)

When this command is given, you have to supply a hex address. Disassembly proceeds from that address.

J(ump)

If the instruction just disassembled was any kind of jump, this command causes disassembly to proceed at the jump's destination address. Thus, you can use the disassembler to trace through a program.

B(ack)

This causes disassembly of the previous instruction.

C(all)

If the instruction just disassembled was a CALL, then this instruction causes the first line of the called subroutine to be disassembled. Disassembly proceeds through the subroutine until you give the instruction.

R(eturn)

Disassembly proceeds with the statement following the CALL. Subroutines may be nested. Use of the R(eturn) instruction is not limited to when you find the subroutine's RTN instruction; it can be used at any time to return to disassembling the calling program.

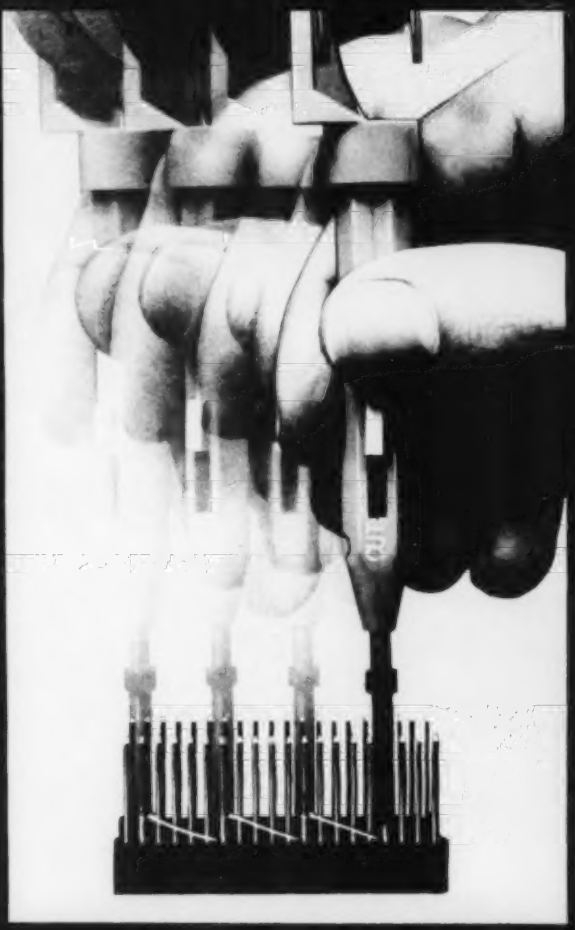
P(revious instruction)

This command has the disassembler go back twelve bytes, then scan forward to the last instruction before the one you started in, trying to align itself to the correct instruction boundaries. If the code you are disassembling isn't making sense, try this instruction. There is a good chance (although it is not certain) the disassembler will now be properly aligned with the program. Of course, if you are in a region of memory that is full of data, then a glance at the ASCII or the hexadecimal columns should show the structure of the data.

Output Format

The address appears at the left edge, followed by the contents of the location (and the next one or two locations if the disassembler thinks that a multi-byte instruction lives there) in hexadecimal. Next is the ASCII representation of those contents (or underlines if they are not printing characters). This is followed by the assembler mnemonic, and then an asterisk.■

NEW!



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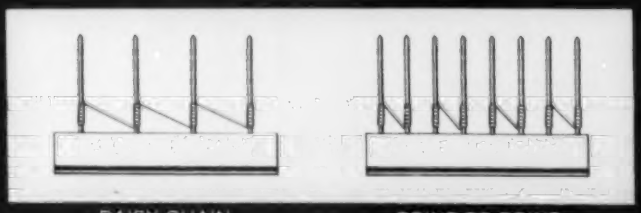

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Most CB equipment can be modified, tuned, or used as is to operate on 10 meters. Many excellent articles have been published on the modification of transceivers. I am working on a vfo to work with these modified units. Each CB modification results in the necessity of a good 10 meter antenna.

The CB industry is manufacturing an array of excellent economical antennas that can be easily modified to 10 meters with a near perfect match. If you are looking for a real bargain, don't overlook your local swap meets.

Here is how to modify several types of antennas. The tuning will be covered later. The actual length will vary with each type of antenna.

Mobile—Base-Loaded Steel Whip, 47 Inches

It was necessary to reduce the whip length to 41 inches. The original whip was retained for 11 meters and another whip was cut for 10 meter operation: swr, 1.2 to 1—29 MHz.

Fixed Station—Vertical Half Wave

No modification: swr, 1.8 to 1—29 MHz. This antenna is known as a Starduster. If you don't mind a little swr, use it as is. Cutting it to length would be difficult since the coax is inside the bottom element.

Fixed Station—Quarter-wave Ground Plane

This antenna had three 106-inch radials and one 106-inch vertical driven element. The vertical element was shortened from 106 to 96 inches. The three radials were not modified: swr 1.2 to 1—29MHz.

The above antennas are being used on 10 meters. The measurements are actual. The following is theoretical.

Mobile—Quarter-wave Whip

Reduce length in accordance with the pruning procedure.

Mobile—Fiberglass Wire-wound

These antennas are made by winding wire around a fiberglass rod and then applying shrink tubing over the entire length. The tuning consists of removing turns of wire from the top end. The frequency is determined by the number of turns rather than the overall length of the glass rod. The size of wire determines the power handling capability. 18-gauge wire will handle 200 Watts.

Fixed Station—5/8-wave Vertical

These antennas normally have a loading coil to obtain electrical length without extending the mechanical length. Tuning would consist of reducing the mechanical length. The loading coil is located in the bottom end of the antenna assembly, and is not readily available for modification. If the loading coil is wound with small wire, it will not handle power. This is a good antenna to stay away from!

CB Beam Antennas

For the modification of beams, refer to antenna handbooks. Check swr and, if it is not more than 2 to 1 and it has a front-to-back ratio on receive, try using it as is.

A contact was made with a ham in Michigan who was using a vertical three-element CB Super Scanner beam as is. S9 reports were received on both ends of the contact.

Mobile—Center-Loading Coil

Tuning is accomplished by shortening the whip on the top end of the coil. The actual length will be critical and the bandwidth narrow.

Loading Coils

Antenna loading coils are sealed against moisture. This is normally accomplished by injection molding or potting the coil in epoxy. Do not attempt to remove coil turns unless you have determined a satisfactory method of resealing.

Power Handling Capability

Antennas without

loading coils are usually good for a kW. RG-58 coax is satisfactory up to 200 Watts input. Above this level, use RG-8/U.

Antennas with loading coils have power limitations. The larger the wire in the loading coil, the more power it will handle. Visual inspection of wire size is usually impossible due to moisture seals.

A clue to power capabilities is the outside diameter of the loading coil housing. If it's ½ inch or less, the power handling capability will be low, not more than 25 Watts. Excess power will cause the coil to heat and possible coil destruction. If there is a gradual increase in swr when the transmitter is turned on, the chances are that the loading coil is working up a fever.

Antenna Tuners

Antenna tuners are not required. Do not have one in the line when changing the length of the driven element. There is nothing wrong with trying a tuner with a CB antenna as is.

Pruning Procedure

Regardless of antenna type, the tuning from 27 MHz to 29 MHz requires the reduction of the electrical length of the driven element.

An swr bridge is required. The function switch is first placed in the forward position and adjusted for set level. The switch is then placed in the reflected position and the swr recorded.

Let's assume your modified transceiver has the following transmit frequencies: channel 1—28,965 kHz, channel 13—29,115 kHz, and channel 23—29,255 kHz. The center frequency is 29,115 kHz, so this is where you should adjust for minimum swr.

Minimum swr will not necessarily be a perfect match—1 to 1. It could be 1.3 to 1 or even 1.5 to 1. Do not settle for more than 1.5 to 1. This would indicate there is a problem somewhere.

A base-loaded mobile CB antenna, when operated on 10 meters, will show an swr reading of approximately 4 to 1. A quarter-wave base antenna will show an swr reading of approximately 2.5 to 1. A loading coil narrows antenna bandwidth.

While pruning a mobile antenna whip, cut off 1 inch at a time until the swr drops below 2 to 1. From this point on, cut only ½ inch at a time. The best way to cut a stainless steel whip is to use the edge of a file to notch the whip and then break off the notched piece with pliers. All mobile antennas have an adjustment screw which allows at least a ½-inch adjustment. With this adjustment, it is possible to obtain minimum swr at the center of your operating frequencies.

Pruning Fixed Station Antennas

The procedure is the same but not as critical. Cut off 2 inches at a time until the swr drops below 2 to 1, and then cut only 1 inch at a time until you obtain minimum swr at the center of your operating frequencies.

In the pruning of any antenna, all swr measurements must be made with the antenna in its permanent position. If it's going to be mounted on the roof, that's where you adjust it. If it's a mobile installation on the trunk lid, close the lid and position the car in the clear, away from all obstructions such as trees, buildings, and other automobiles. Close the car doors during swr measurements. ■

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—a case history

If you're not careful, it's one strike and you're out.

Jerrold A. Swank W8HXR
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This is the story of what happened to Bernie Witherspoon W8GKM during the storm of July 14, 1978. It will show you what can happen even without a direct lightning strike to your antenna. Very few amateurs realize that a distant strike on a power line can cause more damage than a direct strike on your antenna. This is Bernie's story:

"At 4:30 am on July 14th, there was a sudden double click, together with a flash of lightning, in the radio room which is just off the kitchen where I was standing.

"I went into the radio room to check and saw that the pilot light on the two meter rig was out. It is left on all of the time so that the memory will hold the channels on which it is set.

"When I saw that the light was out, I knew that something was amiss. The antenna was switched off for storm protection, and it was free. Otherwise, the damage to the equipment (about $5000 worth), if connected to the antenna, would have been extensive.

"The lightning surge apparently came through the entrance panel and knocked out the fuse for the radio room. It then went through the NCR 12-volt regulated power supply, which originally sold for about $200, and now runs between $50 and $60 as NCR surplus. The inside of the power supply showed extensive damage. It was completely useless.

"The surge then travelled through the equipment via a common ground. It knocked out several transistors and a diode in the Yaesu FT-227R, knocked out a keying circuit in the TR-4CW, and burn-damaged the low voltage circuit in the L4B amplifier.

"It knocked out the power circuits in the R4C receiver. It went through the control box of the Ham III rotator and through one of the screws holding a rubber foot on the control box. The box was sitting on top of a transmatch. It jumped about one-half inch to the case of the transmatch and made a punched hole the size of a ten-penny nail. The surge burned a spot on the transmatch about the size of a silver dollar. It went through the transmatch to the outside, doing a little damage to the inside of the transmatch by burning some of the wiring.

"The amazing thing about this whole bit is that it went through the L4B low voltage panel and R4C control box, and then jumped to the chassis through the transformers without damage to the transformers. It went through several other transformers and did not damage them, although it did knock out two other transformers.

"The ground braid on the coax was welded to the Cantenna dummy load. Although the switch was off on the L4B, the filaments on the 3-500Zs were lit, but not at full brilliance. There were carbon deposits on the switch contacts making a high resistance connection.

"The fuse on the wiring for the rest of the house was not blown. However, it did burn out the transformer on the furnace and the doorbell transformer, plus various small items around the house.

"Since there were two cracks of thunder, I went out to see if the antenna showed any damage. I found half of an insulator on the ground. A neighbor who had been watching said that it looked as if little fireballs were dancing all over the antenna.

"I found that one of the insulating blocks, which hold the center conductor, was broken in two and showed burns. On the metal inserts, which hold the insulators, one of the screws was burned and badly melted. Also, there was some melting where the insulator block was burned in two.

"That strike went down the coaxial line, and each one of the wires in the RG-8 showed signs of being burned. It was not charred, but discolored. When I took the jacket off some of the coax and looked at the clear insulation, it looked like a dark streak inside. Stripping that off, I found that on the inside of the cable each stranded wire was burned.

"Where the coax entered the house under the porch there was a 15-foot length of RG-8, and in that, a PL-259 and a PL-258 were fused together. I was finally able to pry them apart. It short circuited three other PL-259s, badly burned a PL-258, and melted metal on the outside so that it was not usable. There were short circuits in three places in the 15-foot length of RG-8 under the house.

"The estimate of total damage was most fortunate—$332.67. However, I did much of the repair work myself. I replaced the bell transformer and the cable to the dum-

my load.

"The coax switch to the antenna was burned but usable.

"The transmatch was homemade, and a replacement cabinet and panel would cost from $55 to $60. I listed it as $15. I fixed the rotator and L4B myself, and sent the R4B to Drake.

"I also fixed the TR-4CW myself and the VTVM. If all that had been sent out, the cost would have been much more.

"I sent the Yaesu FT-227R to Columbus to be fixed, and they had to send for parts. It took me one month to get it back.

"Except for the Yaesu, I was on the air in a few hours. I have had this setup, and it has always been connected through storms, since 1959, and nothing ever happened, but after 28 years it finally did. I guess if you wait long enough, something will happen.

"Some years ago my father was in the yard holding a steel rim off a buggy, and a cat. Lightning struck the steel rim and went through him, struck the cat, and then hit a boy standing nearby. It killed the cat and the boy, but did not kill my father.

"I have seen lightning strike the ground in an open field less than forty feet from a tree which was thirty or forty feet tall, so it isn't always the highest point that gets hit.

"I have seen it strike water. Once, when I was in the army, I saw it hit a telephone pole. The top third of the pole disintegrated.

"A man on a farm was once hit by lightning and killed. The nails in his shoes were formed into little balls which were rammed up into his feet all the way to his ankles."

Some years ago, W8MPJ, a friend of mine in Dayton, Ohio, had his antenna hit by lightning and it went through the wiring in the house. It burned a pattern on the wall all the way through the house, wherever there was wiring. Strangest of all, in the bathroom, it stripped all the mercury coating off the mirror. On the little side lights by that mirror, there were little knurled nuts that held the lights to the brackets. Those little nuts were unscrewed by the strike and were found on the floor.

The light fixtures were hanging by the wires, still connected. The total damage to the house, for replacing the wiring and fixtures, was over $2000.

Some years ago I had an NCL-2000 amplifier, which was on, and at the same time I was seeing in the distance what we usually call heat lightning. It was a clear day, and there were no clouds in the local sky. But in the distance, miles away, these little flashes could be seen, but no thunder was heard. I noticed that every time I saw these little distant flashes, my NCL-2000 tank would flash over. I disconnected it and stayed off the air until the storm passed.

There is only one word for lightning—unpredictable.

I now have across my 220 line in the radio room a General Electric, 2-pole valve-type secondary lightning arrestor. It should be connected at the input box to the house. It would then protect every appliance in the house. I have it connected across the line to my radio room for the protection of my equipment, since putting it across the input fuse panel would require extensive wiring. GE says that it would completely protect one against these lightning surges. ■

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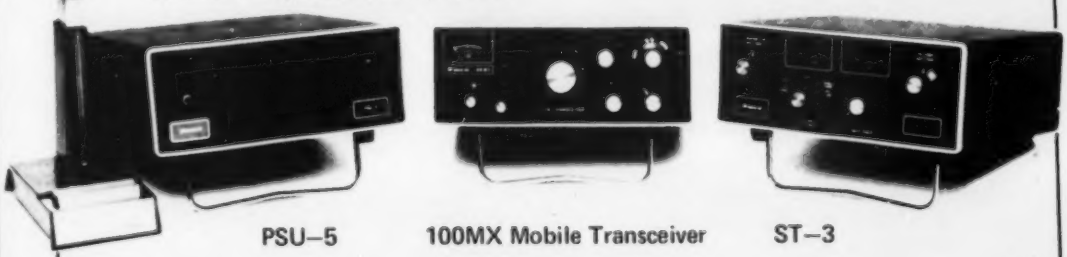

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Probably the most useful of electronic components today is the solid-state memory. This device comes in all sizes, packages, and families. There are RAMs, ROMs, PROMs, EROMs, static and dynamic, and even something called "bubble" memory. These devices are used in so many applications that the list is endless. Even with the latest and greatest microprocessors, the memory is as important as the microprocessor itself.

With the availability and low cost of solid-state memory, I put it to use for the amateur radio operator. Since CW only consists of two states, carrier on or off, this type of memory suits this application quite well. My goal was to design a unit that would be a useful tool for the CW operator. It consists of a

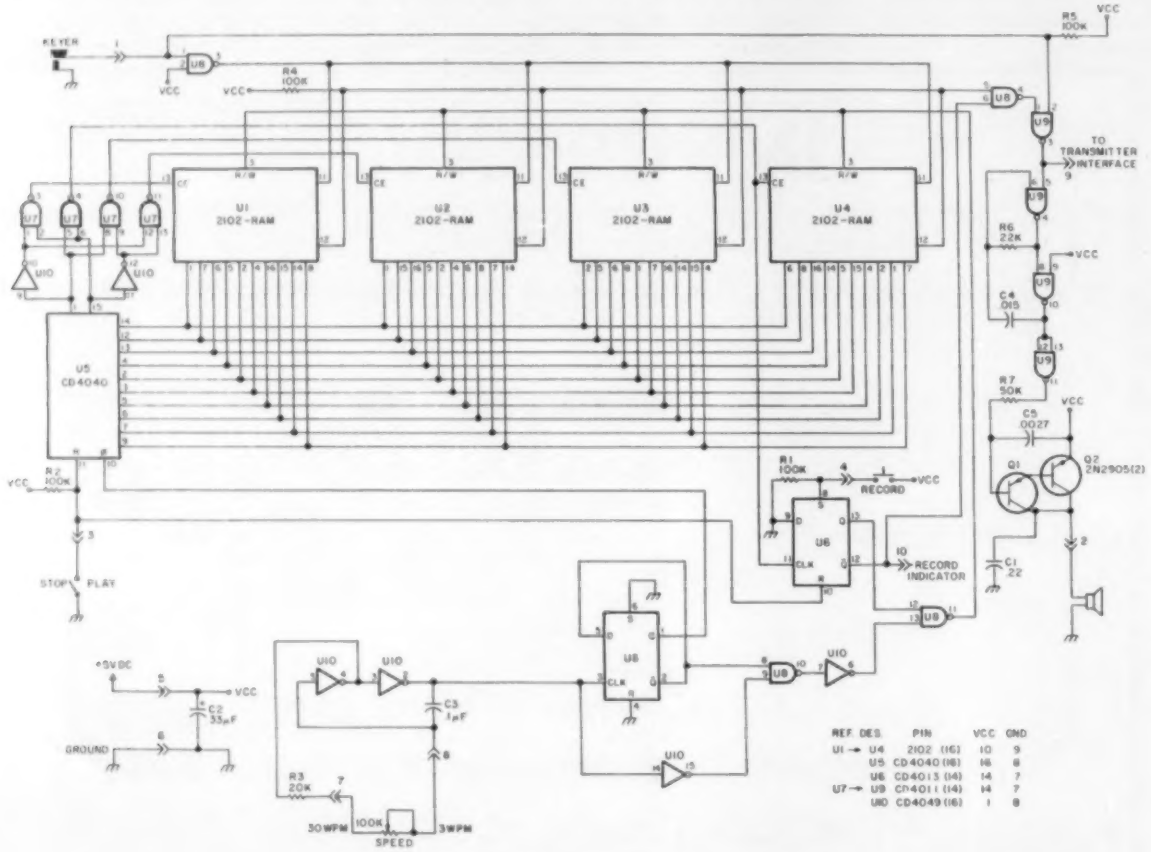

Fig. 1. Code Memory schematic diagram.

memory to store a coded message. The unit actually records what an operator sends with his key. In order to make this recorder more versatile, the rate of speed of the code can be varied without changing the output tone. This makes the unit useful for the beginner when learning the code because he could increase the speed slowly. (This unit could also be valuable in contests for repetitive information such as name, QTH, etc.—ed.)

The schematic and parts identification are shown in Fig. 1. There are ten connections to the circuit. The keyer is connected between pin 1 and ground. This could be a straight key or an electronic keyer as long as the signal is open or ground. An 8-Ohm speaker is connected between pin 2 and ground. The speaker will produce a tone whenever the key is depressed or whenever code is being played back from memory. This tone can be adjusted using either C4 or R6. A volume control can be added by simply putting a pot in series with the speaker. Two switches control the operation of the unit. The play/stop switch, connected to pin 3, when in the open position, applies a reset to U5, the memory address register. This puts the unit in a mode where the memory is idle and the unit can be used as a code-practice oscillator. With ground applied to pin 3, the unit will play back the code that is in the memory. The other switch, the record button, is connected to pin 4 and, upon momentary depression, sets the U6 flip-flop and puts memory ICs U1 through U4 in the record or memory-write mode. The play/stop switch must be in the play position during recording.

Power is applied to pins 5 and 6. A positive 5 V dc is required at about 500 mA. A normal transformer, rectifier, and filter with a voltage regulator, like an LM309, works just fine. To control the speed, a 100k pot is connected between pins 7 and 8. This controls the clock which is used to advance the address of the memory. This pot can be set in any position to record, and any position for playback. With the 4096 bits of memory, good resolution can be obtained from 3 wpm to 30 wpm. Don't try to record 30 wpm code with the pot set for 3 wpm. It won't work. Message times will vary from about 1 minute for a speed setting of 30 wpm to about 6 minutes for a speed setting of 3 wpm.

The Code Memory can drive a transmitter, if desired, provided an interface circuit is used. Pin 9 is available for this, but, note that the signal is CMOS, which is extremely limited in its drive capability. Consult the data sheet for the CD4011 NAND gate before you design an interface. Pin 10 can drive a buffer which, in turn, can be used to drive an indicator to tell the operator that the unit is in the record mode. It should be noted that when in the record mode, the unit will stop recording once the memory is full. The operator can instantly start from the beginning at any time by cycling the play/stop switch.

This Code Memory should be a useful tool for any CW operator, contester, or person learning the code. The cost of the components is less than $10.00, so not only is this a practical project, but also an inexpensive one. To make the construction easier, a two-sided printed circuit board is available for $10.25 from Larry Kasevich WA1ZFW, 78 Jackson Road, Enfield CT 06082. ■

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Wire-Wrap on a Budget

—home-brew your tools

For building many integrated circuit projects, a printed circuit board is considered essential. The alternative is to make many connections in very limited space, and point-to-point soldering techniques are most tedious. One alternative to these wire techniques is wire-wrapping, where each connection is made by wrapping a square post with no. 28 to 30 wire—no solder is required. One limitation to starting wire-wrap construction is the cost of the tool—$6.00 (minimum)—and many people are reluctant to get the starting tools. If your budget is limited and you want to experiment with wire-wrap, here is a no-cost way to begin.

Almost all of us have a few dozen ballpoint pens that refuse to write. Inside many, the refill is a metal tube. These are the type you need; get at least two of them. Some of the more expensive refills have larger upper reservoirs which also make good handles, but any metal ones will suffice. First, clean the remaining ink out of each one. The metal plug containing the ball point should be carefully removed to clean it. Be sure to save the end piece! Cleaning is the hard part and is a little messy. Soapy water and a few pipe cleaners help.

Next, look at Fig. 1 and see how to file the notch in the side of the plug. This is the groove in which the wire will be placed, so make the V-shaped groove large enough for a #30 wire or a little larger so the insulation can also slide in if you prefer the first turn to be of insulated wire. Do not cut the pen end off before you file the groove. It is easier to hold it by that end while you file, and it's small enough anyway. (I lost the first one somewhere in my shop.)

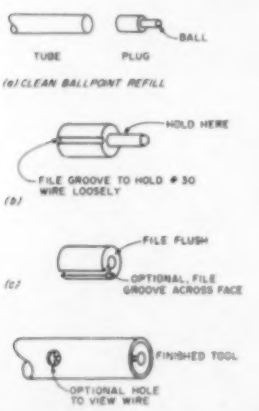

Fig. 1. Wire-wrap tool construction.

After you have finished the groove, carefully cut off the small end of the plug flush with the large diameter. You may insert this almost all the way into the refill tube now and check to see if a wire will pass through the groove satisfactorily. The center hole should be just the right size to fit over a standard .025 x .025 pin. You may wish to file a groove across the diameter end of the plug, connecting the groove and center hole. This aids in causing the very end of the wire to be wrapped against the pin, but is not essential.

Another optional feature is a small hole, just above the groove in the plug, in the wall of the refill tube. This allows you to see the wire pass through the groove. If you look into the hole and cannot see the wire, it went into the center hole, which is wrong. Again, this is an option—drill as small a hole as possible. A no. 80 is large enough, but few of us have that small a drill. A hand grinder with a no. ½ dental burr will cut a nice groove and also drill a small hole, if you have access to one.

This completes the wire-wrap tool. Try it out. With a little practice, you can do as well with it as with any professional model. You will find that more time is spent cutting and stripping wire (if you do not buy the prestripped lengths) and inserting the wire than is spent in wrapping, so that manual tools are only a slight bit slower than motor-driven ones.

Now for the eraser for your mistakes! You need an unwrap tool, too, because you will want to remove wires to make tests, make changes, and correct errors. Since you may wrap a wire in either a clockwise or a counterclockwise direction, you want a tool that works in both directions. Look at Fig. 2. This time, the plug is put into the tube, the small end cut off and filed flush, and the plug is filed back to form a sharp edge which will pick up the end of the wire and unwind it. A triangular file or jeweler's file will help here to get the undercut edge. The edge should be beveled somewhat, as shown in Fig. 2(c). Grooving below the outside edge of the tool is optional. This makes it pick up the wire a little more easily sometimes. Try it on a few of your wraps to see how it works.

Now you are all set to wire-wrap your next IC project. All you need is wire, sockets, and a stripper. A cheap stripper which works well on no. 30 Kynar insulated wire-wrap wire is hard to find. Try using a good double-V stripper set carefully to not nick the wire. ■

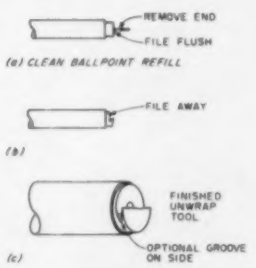

Fig. 2. Unwrap tool construction.

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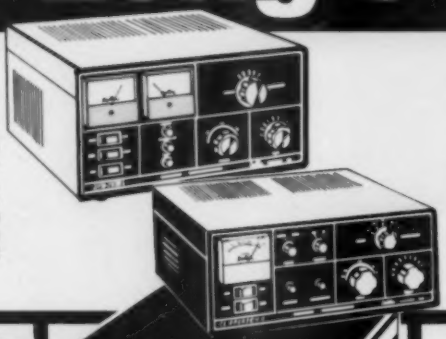

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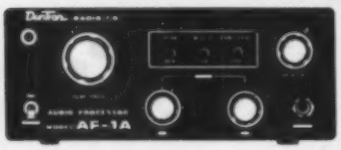

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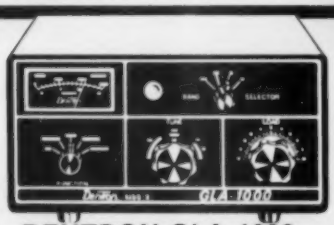

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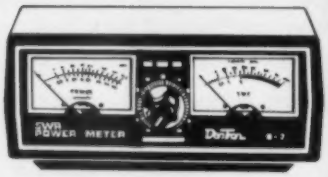

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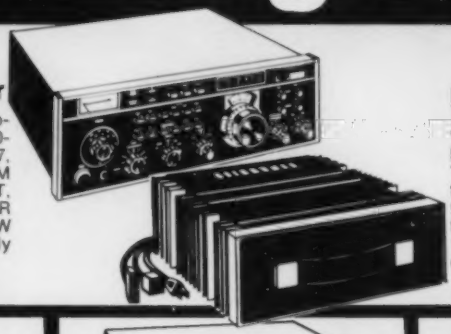

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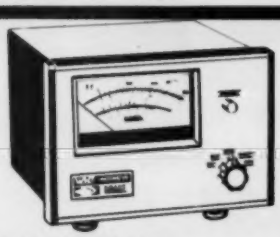

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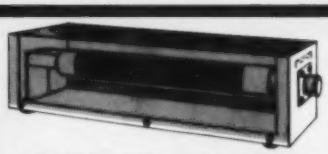

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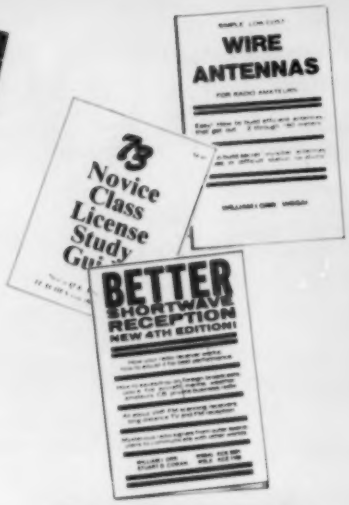

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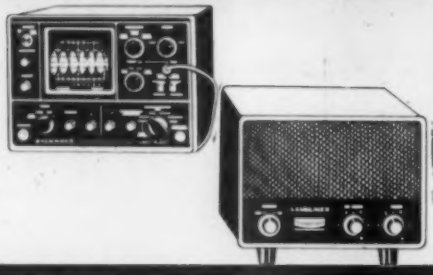

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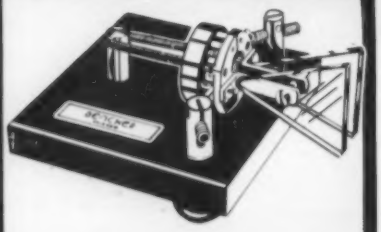

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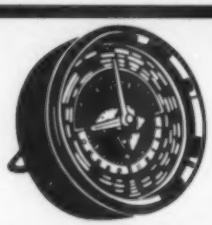

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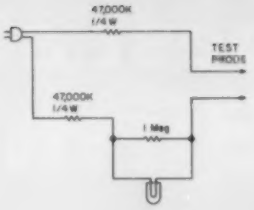
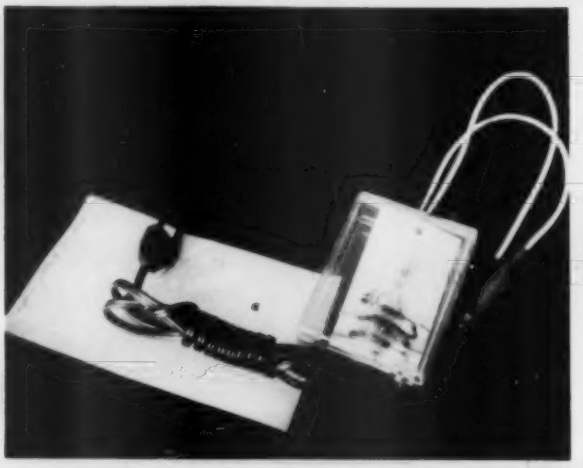


Fig. 1.



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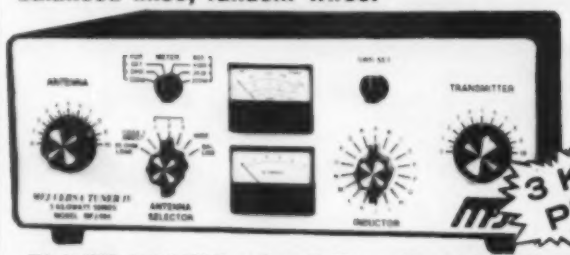

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Reader Service—see page 195

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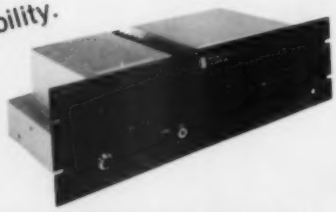

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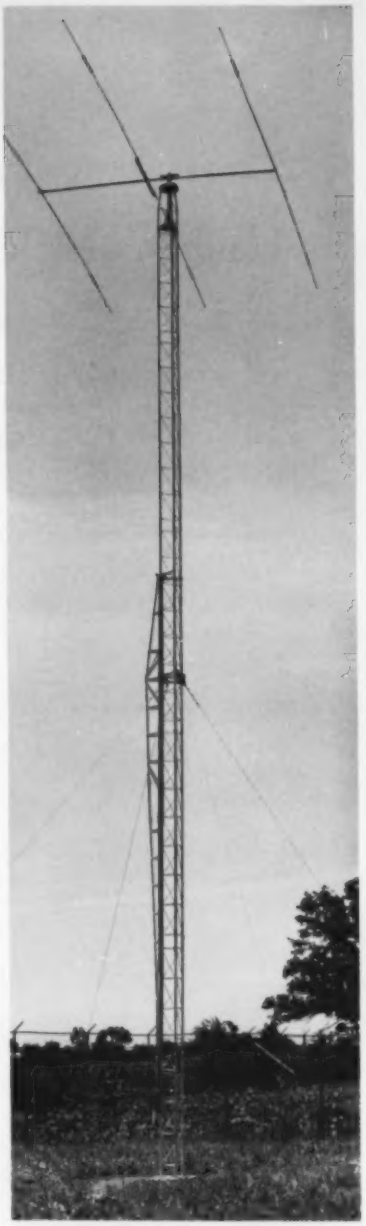

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50 watts	50B1	50A	50B	50C	50D	50E
100 watts	100B1	100A	100B	100C	100D	100E
250 watts	250B1	250A	250B	250C	250D	250E
500 watts	500B1	500A	500B	500C	500D	500E
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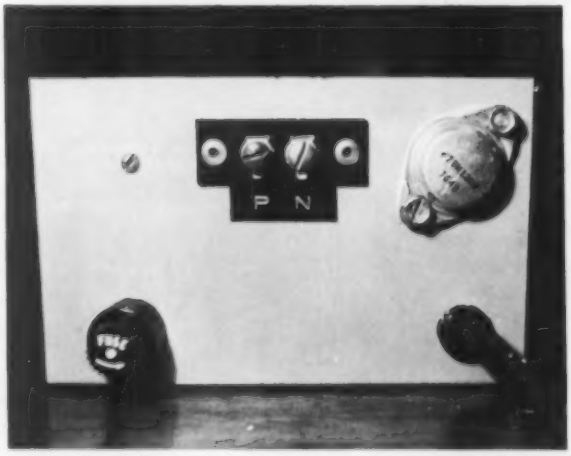
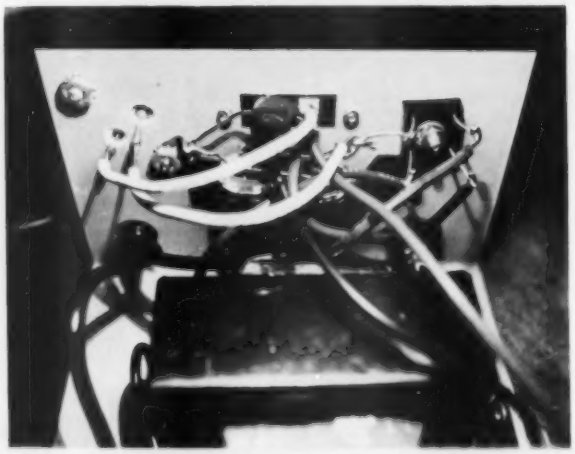
It seems that in the last several months, *73* has carried more than its share of regulated power supply articles. I started to build one of them for use with my TR-22 and my Heathkit® amplifier. Sure, for three bucks or so, anyone can build a regulator for his power supply using a 2N3055 pass transistor, a zener diode, and a few resistors. The only problem is that such a circuit has no protection against short circuits and excessive current draw. To add the extra circuitry for protection can increase the cost considerably.

The solution to my problem was found in a new regulator subsystem by Fairchild. The device, a Fairchild 78H12, is a complete regulator with internal current limiting and thermal-shutdown circuitry in a TO-3-type case. It will handle 5 Amps at 12 V dc before current limiting begins. In other words, the device is indestructible. The price is about $9.00, which is expensive in this day and age, but not for complete protection in a TO-3 case. Other than the power supply capacitors and an output bypass capacitor, no other external parts are needed.

Fig. 1 shows a schematic of my supply. I added the regulator to an already-assembled power supply. Because the device is complete in itself, modification of the power supply was minimal. Also, the company that built the power supply was thoughtful enough to have drilled the holes for a TO-3 pass transistor. So, I simply mounted the regulator in the holes provided, and used a little heat-sink compound. If you plan to draw more than a few Amps, I would recommend using a heat sink—the bigger, the better. Two more steps completed the addition of the regulator. First, I had to break the positive lead between the filter capacitor and the output terminal strip. I then ran a wire from the capacitor to the input (pin 1) of the regulator, and a wire from the output (pin 2) of the regulator to the



The rear of the power supply shown with the 78H12 regulator installed in the holes that were provided by the manufacturer for a pass transistor. The white area around the regulator is not an insulator (the regulator case should be grounded to the chassis), it is common heat-sink compound which helps transfer the heat to the chassis from the regulator.



Inside view of the power supply. The two white wires connect the positive side of capacitors C1 to the input (pin 1) of the regulator, and the other is the output to the terminal strip on the rear. The capacitor on the terminal strip is C2, which bypasses any noise at the output of the regulator to ground.

terminal strip. It was also necessary to ground the negative lead to the chassis, since the case of the regulator must be at ground potential. Don't insulate the regulator from the chassis.

If you are building a supply from scratch, I would recommend the use of a 15- or 18-volt transformer. My power supply uses a 12-volt transformer which develops about 18 volts of unregulated dc output. But, after the current passes through the regulator, the output is only a regulated 11.5 volts dc. Although I haven't tried, I don't think that the full 5-Amp capacity could be reached. Keep in mind, though, that the peak input voltage to the regulator cannot exceed 25 volts.

I've used the regulator with my 2 meter amp and my TR-22. Under key-down conditions, the regulator will become warm to the touch after about one minute. Again, a larger size heat sink would allow more current to be drawn while keeping the regulator cool.

Two other versions are available: the 78H05 for 5 V dc, and the 78H15 for 15 V dc. Both will handle 5 Amps, and are priced the same as the 78H12.■

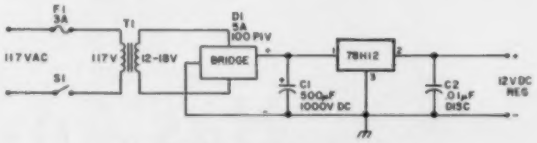


Fig. 1. Power supply schematic.

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Recently, I became a proud owner of a PC-100A printer. Now I'm swamped with printing tape, with every program imaginable all over the kitchen bar. There's even a program strip for how to figure wall paneling with prices and even how many panels per wall. It's amazing how a fellow can come up with off-the-wall programs, especially with the PC-100A.

There was one problem that had been bugging me ever since I heard QSOs on ten meters about a year ago. The problem was how to use the orbit times supplied in *73 Magazine*. I've used the standard 115 minutes added to each orbit, but, when it comes down to the next initial orbit data given, it doesn't figure precisely. Once I got my new toy, it only took 40 feet of paper and an hour to figure out the math of it. The calculator I use is the Texas Instruments SR-56.

Now, here's how I figure orbits. After loading the program (Fig. 1) in the calculator, the next step is to load the initial time inversely into the calculator. For example, 0056:56 goes in as 56(sec.)R/S, 56(min.)R/S, 0(hrs.)R/S. At this point, the

00 54	20 03	40 84	60 34
01 03	21 06	41 02	61 01
02 06	22 00	42 04	62 97
03 00	23 00	43 94	63 84
04 00	24 94	44 35	64 34
05 94	25 33	45 02	65 04
06 33	26 02	46 34	66 94
07 01	27 41	47 02	67 12
08 41	28 54	48 74	68 27
09 54	29 06	49 34	69 07
10 06	30 00	50 01	70 05
11 00	31 94	51 94	71 97
12 94	32 35	52 33	72 22
13 35	33 02	53 03	73 06
14 01	34 01	54 54	74 03
15 41	35 03	55 01	75 41
16 35	36 33	56 03	76 42
17 01	37 00	57 94	
18 41	38 15	58 33	
19 54	39 41	59 04	

Fig. 1.

00 33	19 03		
01 01	20 29		
02 29	21 35		
03 64	22 02		
04 01	23 34		
05 00	24 03		
06 00	25 12		
07 94	26 29		
08 33	27 64		
09 02	28 92		
10 34	29 06		
11 01	30 94		
12 17	31 35		
13 29	32 02		
14 64	33 34		
15 06	34 02		
16 00	35 97		
17 94	36 41		
18 33	37 42		

Fig. 2.

program is awaiting the next day's initial time crossing, 0134:24, and this will be loaded as the previous time was, inversely: 24(sec.)R/S, 34(min.)R/S, 1(hour)R/S. The printout will be in decimal hours, such as 1.573333333. To change the decimal hours into hour-min.-decimal-sec., refer to Fig. 2. Use this program or subtract the hour and multiply the fraction by 60, which will give the minutes. Then subtract the minutes (the integers to the left of the decimal) and multiply the fraction by 60. This will produce the seconds. Fig. 3 shows the process via the PC-100A for 1 hour, 34 minutes, 24 seconds. Should your times start to run over the 23rd hour, remember to subtract 24 from the hours portion to be in the right frame. This is noticeable whenever you're figuring out orbit times in your locale. In reality,

```
1.573333333      -
         1.      =
0.573333333
0.573333333      x
        60.      =
34.39999998
34.39999998      -
        34.      =
 0.39999998
 0.39999998      x
        60.      =
23.9999988
```

Fig. 3.

27.23989316 is 3.23989316 hours. When figuring for your time area, add one of the integers, 4(PST), 5(MST), 6(CST), or 7(EST), to the first initial orbit time and the next day's initial orbit time.

Now for the longitudinal crossings—Fig. 4 shows the program and Fig. 5 shows the results of two days. The positive initial crossings are between longitudes 0 degrees and 180 degrees on the Americas side, and the negative values are on the

```
00 33   20 06
01 01   21 01
02 97   22 05
03 49   23 04
04 01   24 94
05 01   25 97
06 05   26 47
07 01   27 03
08 32   28 02
09 15   29 22
10 34   30 01
11 01   31 02
12 84   32 74
13 02   33 03
14 08   34 06
15 92   35 00
16 07   36 94
17 03   37 22
18 08   38 01
19 04   39 02
```

Fig. 4.

Asiatic and European side of 180-0 degrees. On the initial orbit of Jan. 28, 1978, it was a positive number (58.4); the next orbit crossing will be heading for the international date line at 180 degrees. After the OSCAR crosses the date line, its orbits will take on a negative number; therefore, the first orbit longitude after the date line crossing will be −157.9, and so on and so on.■

```
  58.4    PRT
  87.1    PRT
 115.9    PRT
 144.6    PRT
 173.4    PRT
-157.9    PRT
-129.2    PRT
-100.4    PRT
 -71.7    PRT
 -43.0    PRT
 -14.2    PRT
  14.5    PRT
  43.3    PRT
  72.0    PRT
 100.7    PRT
 129.5    PRT
 158.2    PRT
-173.0    PRT
-144.3    PRT
-115.6    PRT
 -86.8    PRT
 -58.1    PRT
 -29.4    PRT
  -0.6    PRT
  28.1    PRT
  56.9    PRT
```

Fig. 5.

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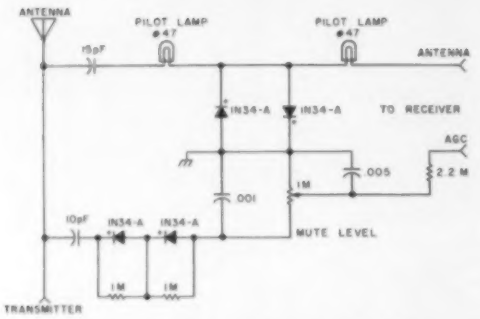

Fig. 1. Poor man's T-R switch schematic diagram.

Here's a dandy little evening project that will delight any CW-man's heart. This circuit (Fig. 1) is a refinement of a design which is simple and effective. The pilot lamps have a characteristic low resistance when not lit and a relatively high resistance as more current is passed through them. A high-level signal (from the transmitter) will exceed the contact potential of the 1N34A diodes and cause them to conduct, drawing current through the bulb. The bulb glows and acts to isolate the receiver from the antenna line. The circuit shown includes an additional lamp in the receiver lead for additional protection of the antenna coils.

Some of the rf energy is also sampled and rectified to provide a muting voltage. Simply connect this output to the agc line of any modern receiver and adjust the mute level for the desired signal level. This circuit works with the agc only when it's fully active, of course.

The circuit shown will work well at powers up to 100 Watts. Additional power may be handled by inserting additional pilot lamps in series with the 15 pF capacitor. This unit causes some loss of received signal strength, but its simplicity and effectiveness will far outweigh this in all receivers. If you aren't fully QSK by now, spend an evening and join in the fun! ■

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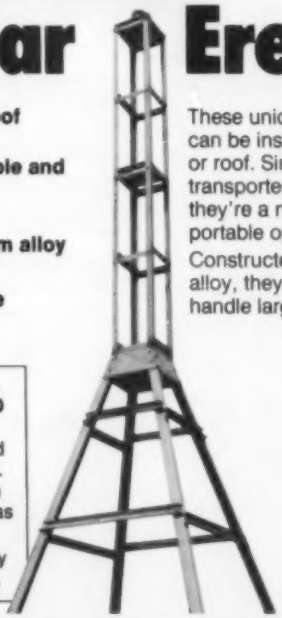

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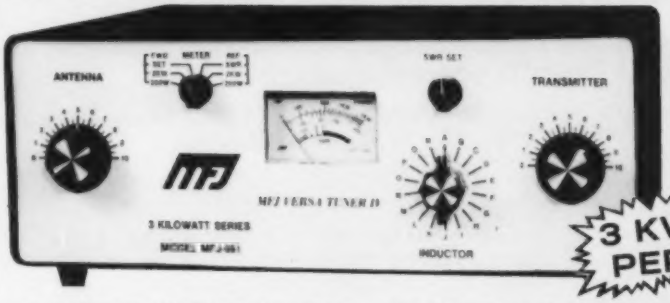

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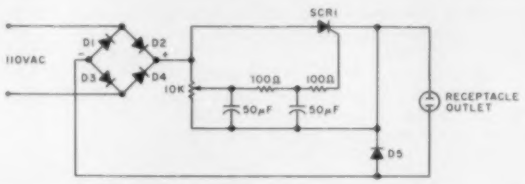

Fig. 1.

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How many times have I heard someone say, "I sure like Heathkits, but I don't know why they don't have RIT," or something similar? RIT, by the way, stands for receiver incremental tuning. (Sometimes it is called receiver-only tuning, or receiver offset, or simply offset.) This feature is found on many transceivers on the market today, and is a means of fine-tuning the receiver without affecting the frequency of the transmitter.

I am the proud owner of a Heathkit HW-104 and have in the past built and used SB-102s, HW-101s, and HW-7s and -8s. For the price, in my opinion, there is no better way to get on the air with state-of-the-art equipment. But no RIT!

Need for RIT

One of the main problems of not having RIT is what happens, for example, when I am talking with another ham who doesn't have RIT, and each of us is busy trying to improve reception of the other's voice. I will retune my transceiver to get a more "natural-sounding" voice; then he will retune his—and we both end up jumping around in frequency. This could end us up close to another station, causing some interference or being interfered with. Since the majority of hams on the air today appear to be using a transceiver, jumping around in frequency or being slightly off frequency are all too common events.

For a time, I used a Ten-Tec Argonaut for a bit of QRP work and became attached to using its offset feature. Upon completion of my HW-104, the first thing I considered doing was incorporating RIT and regaining some of the versatility of the Argonaut's offset control. After the "lids" were on the 104, however, and looking with some affection at my handiwork, I began to have second thoughts.

I've seen additions to equipment by others. Sometimes there is very professional work which doesn't detract from appearances, and in other cases you have to pretend you don't notice the additional switch, jack, meter, or whatever to keep from offending the obviously proud installer. (All the while you're fighting off an impulse to ask what brand of chewing gum was used to stick the little goodie on with.)

An Outboard Vfo

After weighing the pros and cons, I came to the conclusion that, if at all possible, RIT would have to be obtained without any modification to my new 104. Another factor is the ability of the 104 to go from one end of the band to the other without any peaking, tweaking, or anything save changing the vfo frequency (providing you did your antenna impedance design homework). Therefore, to be able to take full advantage of the broadband characteristics of the 104, it dawned on me that an outboard vfo would act as an RIT if proper switching or relay action were provided. In this case, not only would I get RIT, but I would be able also to make use of split operation—perfect for contests and DXing.

Once the decision was made to go to outboard or remote vfo, I began to look around for the best available remote vfo for the price, with ruggedness, durability, and stability, coupled with good eye-appeal. After using the 104, I knew the vfo in the rig was capable of meeting my ideals, but at the time, the engineers at Benton Harbor were on the verge of coming out with the SB-

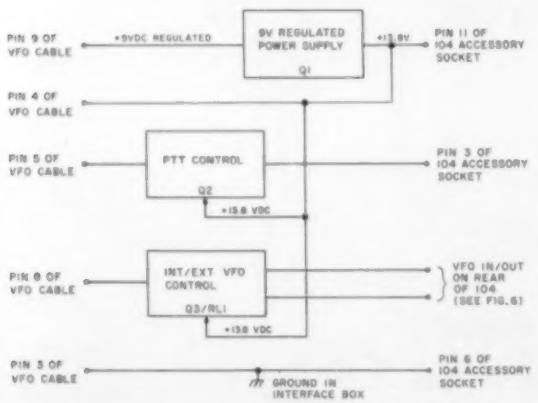

Fig. 1. Interconnection block diagram.

Pin No.	Function
1	Vfo signal
2	Shield for vfo signal
3	Ground
4	12.6 V ac (for lamps) (13.8 V dc used in this project)
5	Relay signal input (goes positive on transmit)
6	Calibrator supply source, 9 V dc (not used)
7	No connection
8	9 V dc for internal vfo
9	9 V dc for external vfo

Table 1.

104A. The remote vfo for the 104 wasn't listed in the catalog, and it would not have had RIT had I obtained one.

Looking around and considering what was still available on the market, I discovered that I could get a remote vfo and RIT in the same box for about the same price as the Heath remote vfo, had it been available. The only problem would be with the controls necessary to obtain selection of internal or external vfo and the push-to-talk (PTT) control for selecting the desired vfo on transmit.

My selection was Kenwood's model VFO-520 remote vfo, since it was readily obtainable and promised to do everything I needed. According to the stated specifications, it was compatible with the requirements of the 104.

The plan from the beginning was to utilize an outboard vfo with no modification either to the vfo or to the 104. This was accomplished by placing all interfacing components inside a miniature aluminum box which I placed out of sight behind the 104. Interconnection between the 104 and outboard vfo was neatly tucked away, and the interfacing was done silently and effectively.

A small cable from the interfacing box connects to the remote vfo. Two short pieces of RG-58 or RG-174 extend from the interfacing box to the rear of the 104, where Heath has provided convenient jacks for the vfo output from the internal vfo and for vfo signal

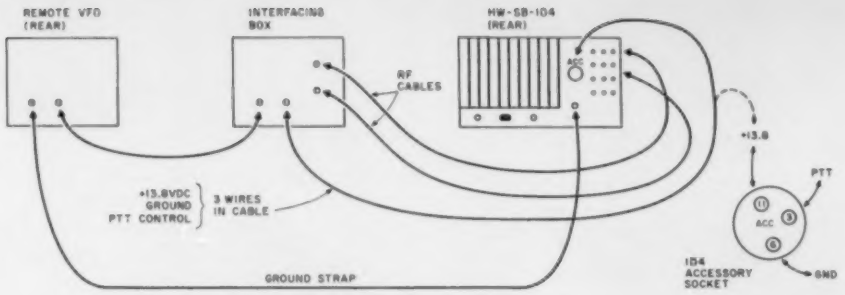

Fig. 2. Interfacing cable layout.

input. Normally, if no external vfo is used, a simple jumper is installed between the two jacks. Only three other wires are necessary: 13.8 V dc, ground, and the PTT signal line. Two-conductor mike cable, with shield, may be used for these last three wires.

Kenwood has come out with a new design level since I purchased my VFO-520, but I imagine the new remote vfo and the old one are electrically equivalent. However, before buying the new one, in case the old one is hard to find, verification with a Kenwood dealer is recommended. Used equipment dealers should be eager to sell remote vfos if they have them in stock, because most hams don't need a remote vfo immediately when buying a new station, and this may leave the dealer with some extras.

The interfacing detailed in this article is what makes the combination work, so parts of the circuitry may be adaptable to other transceiver-to-remote hookups. Before planning to use combinations other than Kenwood to Heathkit, remember the two primary considerations: vfo frequency and which way the vfo is designed to tune. In this case, the Heathkit requires (a) that the vfo tunes from 5 to 5.5 MHz, and (b) that the vfo must tune backwards—which means that for a higher frequency of operation, the vfo will be producing a lower frequency, and vice versa.

The Circuit

A look at Table 1 will give an idea what the requirements of the vfo are and will aid in explaining what the interfacing connections accomplish. Block diagrams in Figs. 1 and 2 show how connections are made and demonstrate just how simple the project is. Figs. 3, 5, and 6 show the builder how few parts are required and may be followed as wiring diagrams. I will briefly discuss the various sections of the circuit, without details of the action of each electron, so that a better understanding of the circuit design and function can be achieved.

The power supply is the most complicated part of the interfacing box, but is actually a very basic circuit. For purposes of explanation, refer to Fig. 4 and notice that current flow is through zener diode D1 by way of resistor R1. Since a zener diode is designed to pass a large amount of current in the reverse direction when voltage across the diode reaches a certain level, it performs as a voltage reference device. In other words, as the voltage is raised across the diode, more current is passed by the diode at a certain voltage level, increasing the voltage drop across R1. In turn, this tends to stabilize the voltage across D1. The value of R1 is chosen to provide enough current for stable zener diode operation and to limit current through the diode to a safe value.

You may recognize transistor Q1 as operating in a standard emitter-follower amplifier circuit, but it is enough to remember that when Q1 is operating, a nearly constant voltage difference of a specific value is maintained between the base and emitter, mainly determined by the physical properties of the type of material used in making the transistor. For

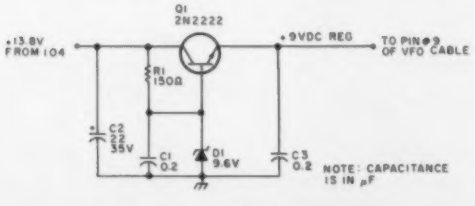

Fig. 3. 9 V dc regulated power supply.

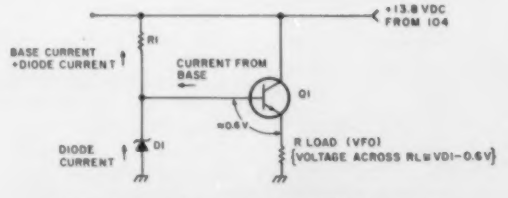

Fig. 4. Power supply simplified circuit.

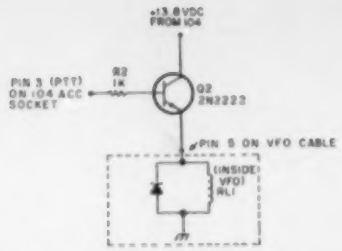

Fig. 5. Vfo relay switching circuit.

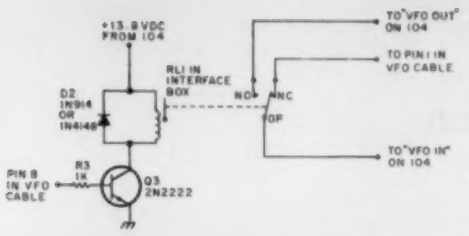

Fig. 6. Interface relay switching circuit.

silicon, which is used in the 2N2222, the voltage difference is about 0.6 V dc between base and emitter, and due to the clamping action of D1 on the base, the emitter circuit will supply current at a constant voltage. Capacitor C1 is used for insurance against the possible generation of white noise in the zener diode, due to random current paths in the silicon permitting "bumping," or friction, between groups of electrons, and resulting in a hissing sound.

Transistors Q2 and Q3 are used to operate relays, acting as current switches. R2 and R3 limit current in the base circuits to a safe value in the transistors and provide some isolation between the circuits. Diode D2 is used to limit to a safe value the "flyback" voltage generated as the relay winding is de-energized, since the inductive kickback voltage is usually high enough to jeopardize the switching transistor. Without this diode, the transistor could be "punctured" and destroyed.

Construction

All parts are common parts which either I had on hand or I bought at the local Radio Shack store. Table 2 gives a list of parts, and, while some substitution is possible, I recommend going with a winner and sticking with the circuit given, unless you like to experiment.

Silicone rubber compound, such as General Electric's RTV, would make mounting the relay a snap if you have it around. Perforated experimenter board can be used to mount the parts, but I soldered the parts to the pins on the 9-pin socket and rf connectors and experienced no mounting problems. Sockets for the rf cables between the interfacing box and transceiver may be considered unnecessary, but are recommended in order to keep everything grounded and shielded.

The VFO-520 comes with an interconnecting cable which has a 9-pin plug on each end. This cable is straight-through—that is, pin 1 goes to pin 1, etc., on each end of the cable. Also, pin numbering is standard, counting clockwise, starting from the large space between pins while looking at the bottom.

Remember to use the ground wire provided to strap the transceiver and vfo together, since depending on signal wire shields for grounding is poor practice. If the ground wire provided isn't long enough, one should be made up, since noise could be experienced later as connectors become dirty or oxidized.

Operation

Since placing the remote vfo in service, I have not had any problems whatsoever. Stability is as good as the 104 vfo, and that's pretty good. In fact, for almost all general operating, the Kenwood vfo is used exclusively. At first, one might think the price is pretty high just to get RIT, but not only do I now have RIT and the capability of comparing vfo operation, I also have the ability to set up operation on another band by verifying frequency availability and then moving with just a flick of the bandswitch. Actually, I now have the same capabilities as if I were using a separate receiver and transmitter, except for crossbanding.

I thought at one time I had a stability problem, but it turned out to be an oxidized bandswitch in the 104, and cleaning with a pencil eraser did the trick. (Take note, 104 owners.)

The function switch on the remote vfo gives total control over operating frequency. The four positions of the function switch are as follows, along with operating mode if the indicated position is selected:

OFF—Remote vfo is off. Transmit and receive frequencies are controlled by vfo in rig.

REC—Remote vfo controls receiver; rig's vfo controls transmitter.

REC/XMIT—Remote vfo has total control.

XMIT—Remote vfo controls transmitter; rig's vfo controls the receiver.

Summary

I don't expect any trouble from my vfo in the future because, upon inspection of the interior of the VFO-520 (I have a thing about looking inside every new thing I buy), I found good construction techniques were used, both electrical and mechanical. There was shielding where I didn't expect it, in fact. There is no reason why the VFO-520 cannot be used with other rigs with a little bit of homework, and I hope I've made it clear enough so others can duplicate the project without too much trouble. I also hope that those who do will get as much enjoyment out of the expanded operating capabilities as I have—all without modification to the rig or the vfo. ■

Component or Part	Quantity	
Transistor, 2N2222, silicon NPN	3	Q1, 2, 3
Resistor, 150 Ohms, ½ Watt, carbon, 10%	1	R1
Resistor, 1 kilohm, ¼ Watt, carbon, 10%	2	R2, 3
Capacitor, 0.2 uF 50 V dc min., disc ceramic	2	C1, 3
Diode, 9.6 V dc zener, 1 Watt*	1 (or two 4 V dc zen)	D1
Diode, 1N914, or 1N4148 switching diode	1	D2
Relay, Radio Shack No. 275-004 at $2.89	1	RL1
Capacitor, 22 uF, 35 V dc; RS No. 272-1014 at $.49	1	C2

*Two 4-volt zeners in series were used, but verify 9 V dc from power supply.

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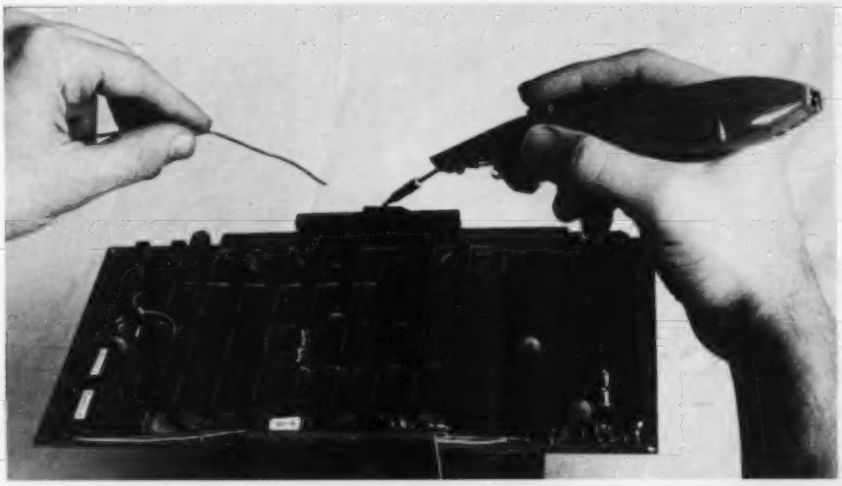

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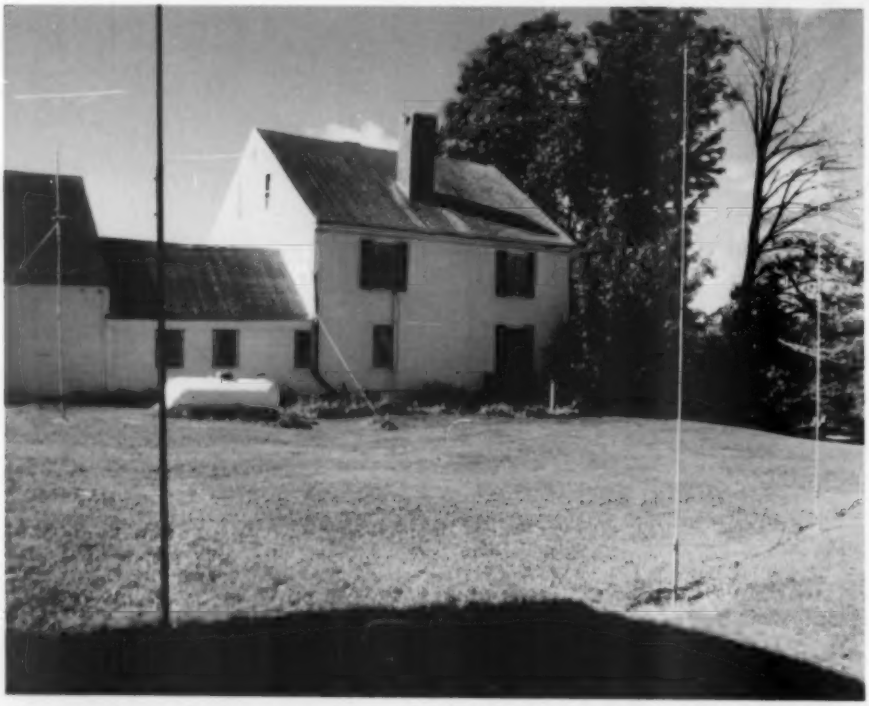
An 8-Element, All-Driven Vertical Beam

—super array for DX

Good news from New Hampshire.

The most popular 20 meter beam antenna in use today is the yagi mounted horizontally on top of a tall tower. A "package" price on such an antenna, a three-element triband beam, a rotator, a 51-foot crank-up tower, and 100 feet of coax and rotator cable was recently advertised in ham magazines at $1,095. In addition, you will have to pay for shipping and cost of erection (including concrete, guy wires, anchors, etc.), to say nothing of the legal fees to defend yourself against the local zoning board because you erected a 51-foot structure on your property without a building permit. To avoid the above expenses, I designed and built a vertical array over a ground plane with a maximum height of only 16.4 feet and a total erected cost of only $60, plus a few bucks for the extra RG-58/U needed, thus saving well over $1000.
well over $1000.



A general view of the array in relation to the shack which is in the upper rear room of the old farmhouse.

Vertical beams described in the literature are generally either two- or four-element ground-mounted phased arrays for 3.5 or 7 MHz.[1] The directivity of these beams can be changed by various switching arrangements. The usual method is to switch in coils of coax cable cut to the required length for the number of degrees lag required. This is relatively simple for two elements. However, the gain from such a two-element beam is also relatively low. To increase the gain, it is necessary to increase the number of elements in the beam. Four is usually the

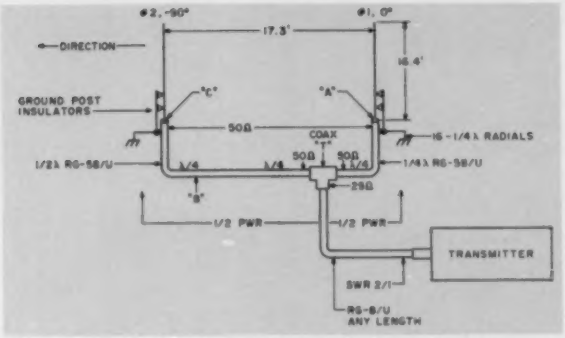


Fig. 1. Method of feed for the 2-element phased array.

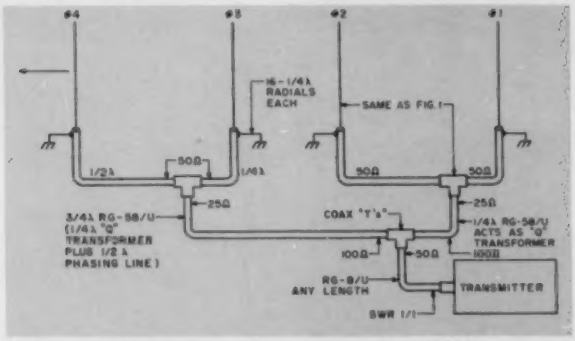


Fig. 2. Method of phasing and power division for the 4-element array.

maximum number of elements used. These may be arranged in a straight line, a square, or a triangle, with the fourth element in the center.[2] The complexity of the switching and phasing increases at a faster rate than the gain from such an array. Although the gain is low from such an array, it is more than adequate on 3.5 and 7 MHz, where rotatable beams are very expensive and difficult to construct.

To get enough gain on 14 MHz from such an array to be competitive with yagis and quads on towers, at least eight elements are necessary. Therefore, I sketched up an eight-element phased array with switchable directivity, but gave up the idea after calculating the number of relays and the feet of coax cable that would be needed.

Parasitic Array

One-half of an eight-element yagi (split down the middle) mounted vertically over a ground plane looked really interesting[3] since it only required a single length of RG-8/U for a feeder and could possibly be made into a tribander for 20/15/10. An eight-element parasitic beam could not have its directivity switched, but since I had already given up that idea, I decided to go ahead with a large high-gain unidirectional beam fixed on Oceania. It was decided to start with four elements, a reflector, a driven element, and two directors, later expanding it to eight or more elements by adding more directors. With this in mind, I reviewed the literature on yagi antennas. A 20 meter beam is generally limited to three elements only because of the difficulty in supporting a long boom 50 to 60 feet up in the air. Imagine the wind and ice load of an eight-element beam with an 80- to 100-foot boom! This is no problem on VHF where high-gain 10- to 16-element yagis are common. Neither is it a problem on HF when the beam is vertical with each element mounted on its own ground post.

Since I wanted my beam to point to Australia, which is 270 degrees true from central New Hampshire, I drove a 5-foot ground stake of 1-inch diameter pipe into the ground and attached the driven element to it. At precisely noon sun time, a stake was driven at the end of the shadow of the driven element.[4] This established true north. Next, I measured off 90 degrees and drove another stake, marking the true east/west axis of my new beam. The three ground posts for the reflector and two directors were installed next, together with their elements, along this east/west line. A length of RG-8/U was hurriedly run from the shack to the driven element just before dark. There was no time to install radials, but I did have a good (?) ground, four pipes driven into the moist soil to a depth of 3 feet.

At 6:00 am the next morning, I called CQ and was elated that VK3AKK answered and gave a report of strength 5 on a rather poor band. I was delighted that the first QSO on my new Australian beam was with a VK station. Anxious to see how much better it was than my other antennas, I switched in turn to a Hustler 4BTV, a dipole, and an eight-wavelength longwire. Ken came back saying: "Don't slash your wrists or cut your throat with this report, but although your new beam is a good S-5, the 4BTV ground plane is an S-7 and the dipole is an S-9. The longwire (pointing at South America) is an S-6."

So, back to the drawing board! It seems I have read somewhere that a pipe driven into the ground makes a good lightning arrester but not an rf ground! An swr check showed an extremely high swr ratio, so a 50-Ohm dummy load was placed at the far end of the coax. The swr came down to 1 to 1, showing the cable to be OK. Realizing that the trouble was probably due to the lack of a ground plane, four radials, each ¼ of a wavelength long, were installed at the base of each element. The swr immediately came down to 3 to 1.

A field-strength meter was set up about 60 feet in front of the beam, and the lengths of each element were varied in steps of 2 to 3 percent both ways with no very conclusive results. The elements did not want to tune. It appeared that I was trying to adjust the length of an element an inch or so at a time against some unknown random length of a ground system. Four more radials were added, making a total of eight radials per element. I reset the lengths of each element to 5 and 10 percent shorter for the directors and 5 percent longer for the reflector and ran another swr check. The swr was now down to 2 to 1, a worthwhile improvement.

The next morning, another CQ raised VK4AGL. The new beam was beginning to work. Joe gave me the following comparative report: new beam S-9, dipole S-8, 4BTV S-7, longwire S-5. It appeared I was now in business, so I started adding more elements, more radials, and a 4-to-1 step-down transformer. After each change, I would collect comparison reports for about a week. The greatest improvement in reports resulted from increasing the radials to 16 per element. The final 8-element

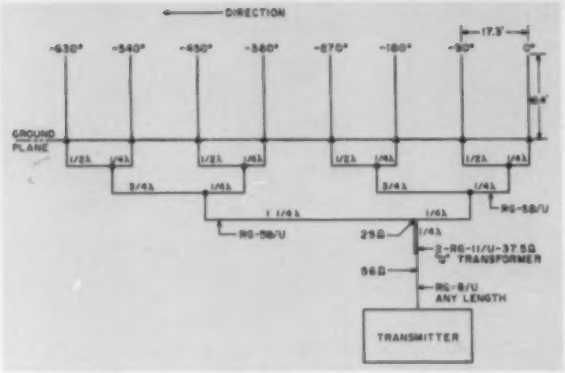


Fig. 3. Feeding and phasing an 8-element array. Note the 37.5-Ohm Q transformer. Refer to Fig. 5.

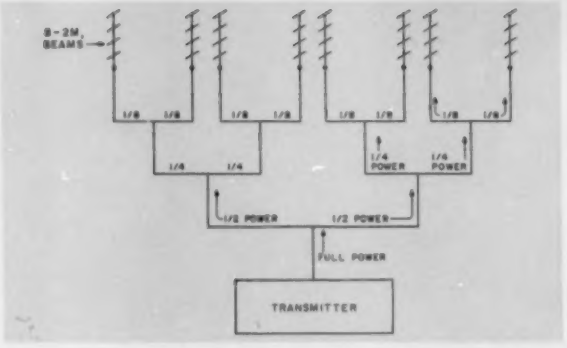


Fig. 4. Feeding eight 2 meter beams in phase with equal power. Feedlines to all beams are of equal length for in-phase operation. This is the type of phasing harness to use for broadside directivity of the 8-element array.

yagi beam gave a consistent two S-unit increase in signal strength (about 12 dB) over the best of my reference antennas. I still was not happy with the beam because I could not see any definite results from trying to tune it. Adjusting the lengths of each of the eight elements became very tedious and time-consuming. It was decided, therefore, to try an all-driven 8-element phased array, starting with two elements, then going to four, and then to all eight.

Phased Array

In a phased array, there are two things to watch out for: First, if ¼-wavelength spacing between elements is used for end fire, then there must be a 90-degree lag between elements, and second, the power must be divided equally among all elements.[3] The first problem is solved by feeding the first element directly from the coax from the transmitter and then feeding the second element through an extra ¼ wavelength of coax. Now, obviously, an electrical ¼ wave of coax, 11.4 feet, will not reach between two ¼-wave spaced elements, 17.3 feet; therefore, we must lengthen the coax to each element by an equal amount. For ease in grid-dipping each length of coax, I chose to lengthen each coax by ¼ of a wave. Refer to Fig. 1 for the power division and phasing of the first two elements. The formula for the electrical length of a quarter wavelength of coax is: L in feet = 246 × V/f = 11.39 feet when f (frequency in MHz) = 14.25 MHz and V (velocity factor) = .66.

Handbooks say that V equals .8 for foam dielectric RG-8/U and .66 for solid dielectric. This makes a good starting point. Be sure to grid-dip your particular coax to 14.250 MHz, each time checking the grid-dip frequency on your receiver. Solder a 1-inch diameter loop onto a coax chassis fitting and then screw on the length of coax to be checked. If it is solid dielectric cable, then it should be cut to a few inches longer than .66 times ¼, ½, ¾, or 1¼ wavelengths and then pruned to length with the grid-dipper. When dipping the ½-wave coax, set the dipper at 7.125 MHz and read its second harmonic at 14.250 MHz. For all odd quarter wavelengths of coax, set the dipper at 14.250 MHz. The end of the cable you are pruning must be open-circuited. It was interesting to note that none of my coax had a velocity factor, V, of .66; it varied from .59 to .62.

Referring again to Fig. 1, you will note that the power from the transmitter is hopefully divided in half by the coax "T", one half going to element #1 and the other half going to element #2. Also note that points A and B are equidistant from the coax "T"; therefore, there is no phase difference between them. There is, however, an additional ¼ wavelength of coax between points B and C; therefore, it takes the signal that much longer to reach point C. Since there are 360 degrees in a wavelength, ¼ of a wave equals 90 degrees, and the signal in element #2 is said to "lag" that in element #1 by 90 degrees. This same method of feed will be used for each pair of elements.

This 2-element phased array was used for a week working VKs and ZLs, with results equal to the 4-element parasitic beam. Of course, by now I had a better ground plane than earlier. Next, two more driven elements with ¼-wave spacing were added. In each case, the division of power was hopefully accomplished by simply installing a coaxial "T" in the line as shown in Fig. 2. Phasing was accomplished by feeding the two pairs of elements through a ¼-wave and a ¾-wave section of coax as shown. The reason for doing this was to avail myself of a pair of ¼-wave matching transformers. If each of the driven elements had feedpoint resistances of 50 Ohms, they would be in parallel at the first "T", producing 25 Ohms of output. Now, if we connect in a 50-Ohm coaxial transformer an odd number of quarter waves in length, we can raise this 25 Ohms to 100 Ohms. $Zo = \sqrt{Zr \times Zs}$, where Zo is the line impedance (in our case, for RG-8/U, 50 Ohms), Zr is the impedance at one end, and Zs is the impedance at the other end, 25 Ohms. $Zr = Zo^2/Zs = 50 \times 50/25 = 100$ Ohms.

Now, at the next "T", we have two 100-Ohm resistances in parallel, giving us the desired 50 Ohms for the RG-8/U. An swr check bears this out. The swr with two elements was a little over 1.5 to 1. With the four elements and the transformers, it dropped to almost 1 to 1. The element lengths and the spacing had been calculated from the following formulas: All ¼-wave elements, length in feet = 246 × .95/14.250 = 16.4 feet. All element spacing, in feet = 246/14.250 = 17.26 feet.

A week of operation proved that the four phased elements equaled the 8-element parasitic beam. Many VKs and ZLs were worked, as well as some long-path contacts to

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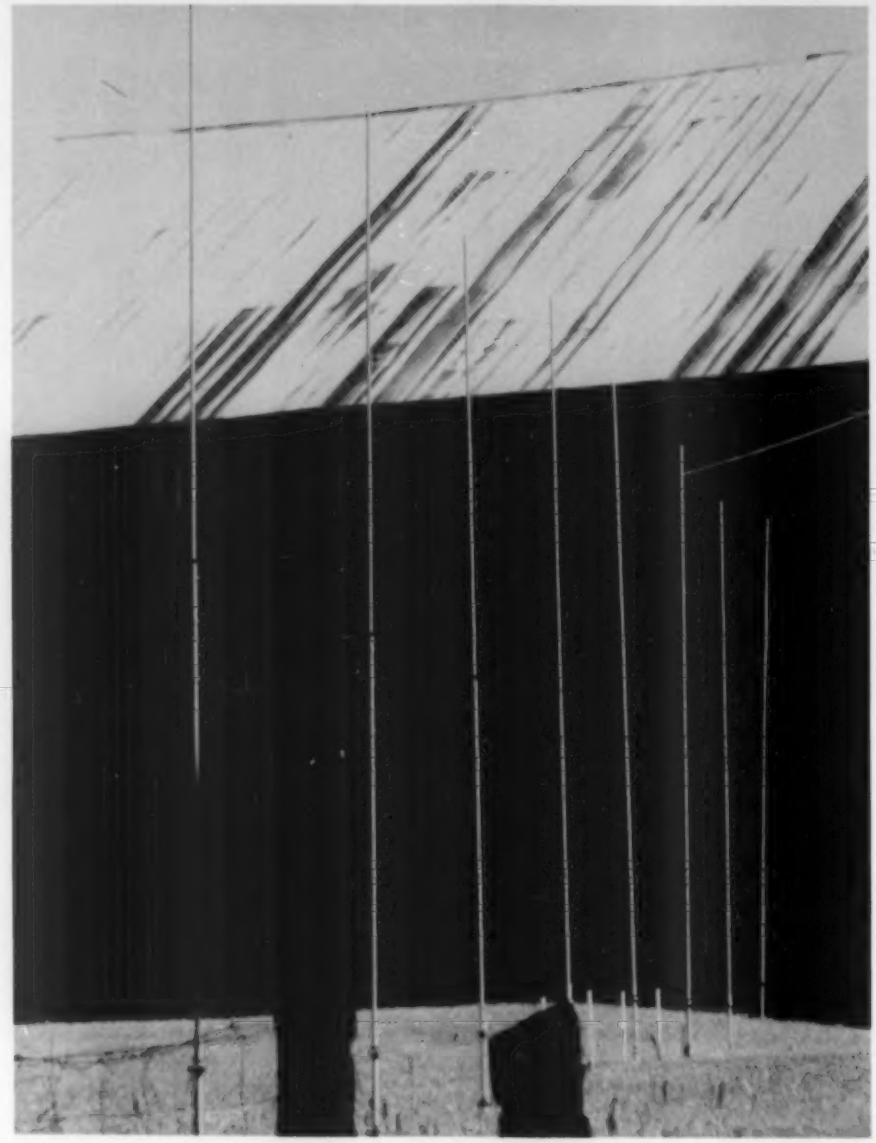


A view of the array from the highway with our old cattle barn in the background. This view is looking to the east off the back of the array and causes considerable comment among passing CBers. I often notice truck drivers looking out their windows with mike in hand . . . "Got your ears on, good buddy?"

the Indian Ocean, South Africa, and the South Atlantic. Another set of four elements was installed, one at a time, in line and phased, the same as shown in Fig. 3. The second group of four elements was delayed the proper number of degrees each by feeding them off another "T" with a 1¼-wavelength coax line.

The method of power division into eight equal parts is patterned after the way you would divide the power to eight two meter beams. I used this method very successfully in the 1950s on a 32-element beam for 144 MHz. Fig. 4 shows how it is done. No measurements have been made to find out exactly what the power division actually is between elements; however, judging by the array's performance, it must be fairly correct.

Swr measurements with various numbers of elements are as follows: 1 element, 1:1; 2 elements, 1.5:1; 3 elements, 3:1; 4 elements, 1:1; 5 elements, 2:1; 6 elements, 3:1; 7 elements, 2:1; 8 elements, 1.5:1. The addition of a ¼-wave Q transformer, Fig. 5, made up of 2 parallel lengths of 75-Ohm coax, as shown, raised the 25-Ohm output of the last "T" to 56 Ohms, close enough to 50 Ohms to give an swr of 1:1 for the transmitter to look into. Several weeks of tests on the completed 8-element phased array show that it tops the parasitic beam by a good S-unit. This is perhaps because I was never able to get all six directors and the reflector properly tuned for maximum gain. It appears that a parasitic element requires a much more perfect ground plane for tuning than does a driven element. At any rate, the all-driven array was much easier to get going than was the parasitic array. I suspect that an all-driven 4-element rotary beam would outperform a conventional yagi.

Construction

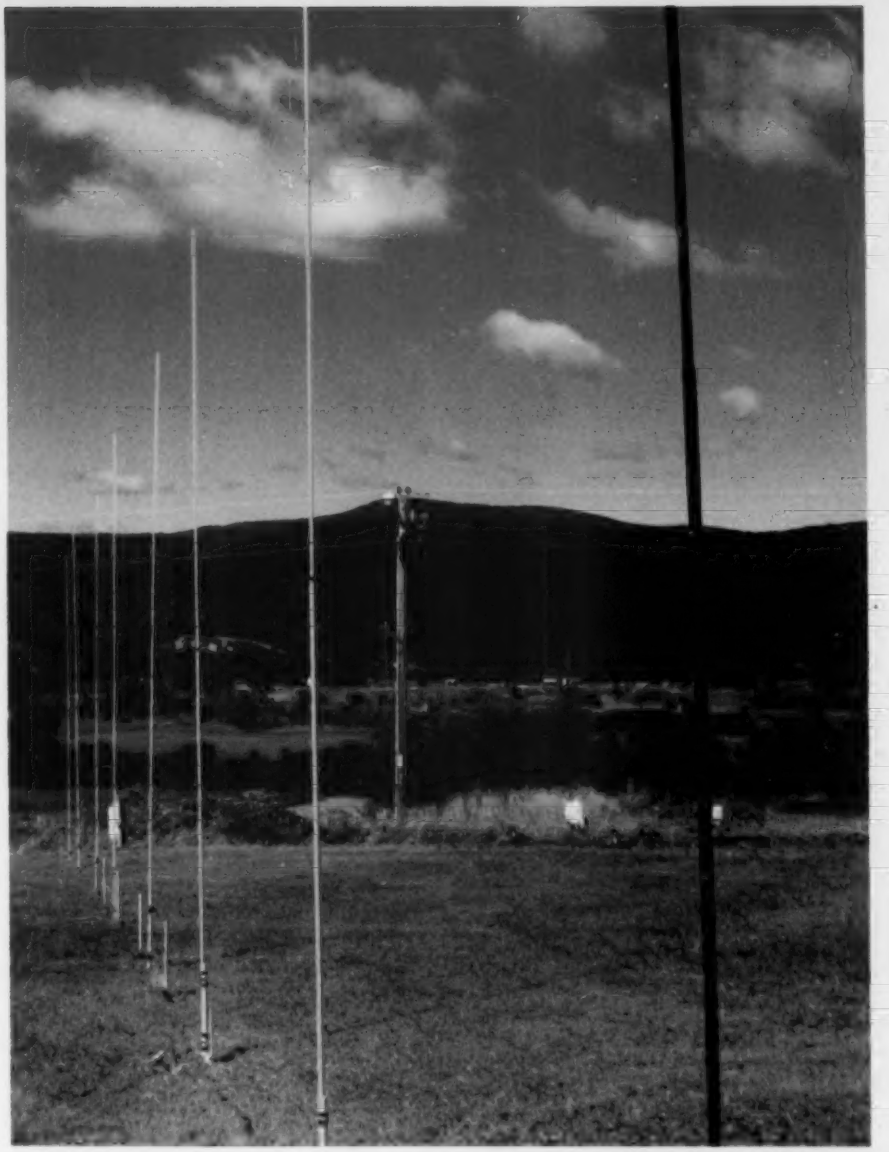
A readily available source of inexpensive tubing for this array is thin-walled galvanized steel electrical conduit, found at most electrical supply houses or discount stores. Each element is made up of a 10-foot top section of ½-inch diameter tubing telescoped into an 8-foot bottom section of ¾-inch diameter tubing. The two sections are accurately measured to 16.4 feet and then fastened together with three 10/32 machine screws tapped into the outside tube.

The ground post is a 5-foot section of 1-inch-diameter tubing driven 3 feet into the ground with a sledgehammer. Be careful to get it exactly vertical using a carpenter's level so that all your elements will line up nicely. Cut off the top 2 inches to get rid of the deformed part caused by the pounding.

The driven elements are each insulated from the ground posts with thick-walled plastic conduit or rigid plastic water pipe.

This is cut into 3-inch lengths and split lengthwise, one size to fit the ¼-inch conduit and one size to fit the 1-inch ground post. See Fig. 6. The RG-58/U is attached to the bottom of the element with a 10/32 machine screw, while the braid, after tinning, is clamped to the ground post along with 16 radials by using a stainless steel hose clamp right at ground level. The plastic insulators are squeezed into place with a C-clamp about 18 inches apart and held there with black vinyl electrical tape until the elements are secured with TV U-clamps.

Remember that the element length is from the top of the element to the point where the radials are clamped to the ground post. Fig. 7 shows the right and wrong way of attaching the radials. Keep the leads on the end of the coax as short as possible, as these add to the length of the driven element. It would be wise to give all the pieces of conduit a couple of coats of rust-proof paint before erection. Also, put corks in the top of each element and ground post to keep out water which will freeze and split the tubing in the winter. Tape the joint of the ½- and ¼-inch tubes with vinyl tape for the same reason.

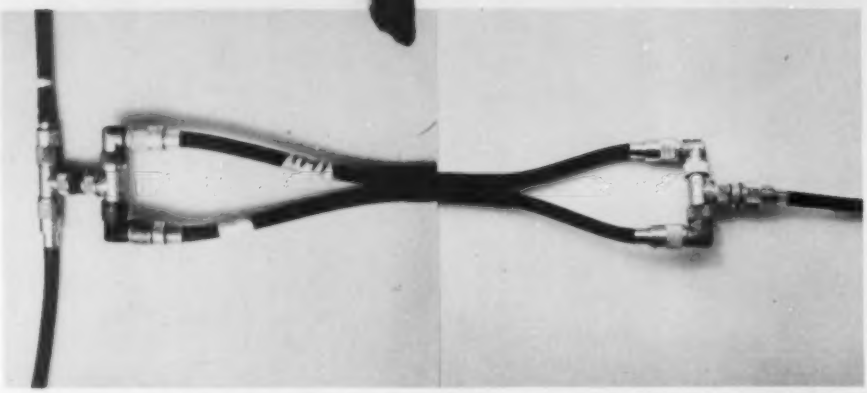


Looking west along the line of the array: The Connecticut River flows in the valley and the hills in the distance are in Vermont. Note that the top of the 7th element is just even with the horizon. A little trig with a pocket calculator tells us that our minimum angle of radiation is about 6 degrees.

Ground Plane

There have been a number of papers published recently[6] on the importance of ground radials or ground planes for vertical radiators. Most of these have been for single-element verticals or for shortened verticals. They have compared the efficiencies of several different ground planes using various numbers and various lengths of radials. A broadcast band station normally uses 120 radials, each 0.4 wavelengths long. If you plan to do this at 14 MHz for each of 8 elements, you will have to bury about 5 miles of wire in your yard, and if you do not want any TVI, you had better solder each place that the wires might touch each other or insulate them well. See Fig. 8. A poor joint will rectify your signal and generate harmonics.

Since I had found no information on the number of radials needed for an 8-element array, I decided to start with none and add them a few at a time until there was no longer any noticeable improvement. You have already read of the disastrous results with no radials and of the improvement as radials were added. If you decide to stop at 16 radials as I did, you will need 16 × 8 × 17 or about 2176 feet of wire, just under ½ of a mile. I bought two ¼-mile spools of #17 galvanized electric fence wire from the local farm supply store for $12. To solder the crossover points before burying the wire, I used acid core solder and then brushed the joint with baking soda to neutralize the acid. The radials were buried a maximum of 1 inch in the sod so that they would not get



This photo shows the use of coaxial fittings in construction of the 37.5-Ohm quarter-wave matching transformer. Refer to Fig. 5 for dimensions. RG-8/U from the transmitter connects at the bottom. The coax leaving the "T" at the top of the picture drives the right-hand and left-hand halves of the array, respectively.

tangled up in the lawn mower. The less "lossy" the dirt over the radials, the better. Fig. 8 shows the layout of the radial system. The dots indicate soldered crossover points.

Coaxial Cable

RG-8/U solid dielectric coax was used for the feedline from the transmitter to the first "T". RG-59/U, 75-Ohm, was used for the 37.5-Ohm ¼-wave transformer, and RG-58/U was used for the phasing harness. Of course, you could use the larger coax throughout if you have it available.

Results

How do you report on the merit of a new beam? The usual method is to set up a field-strength meter and rotate the beam, noting how the field strength varies with different headings. You could calculate the theoretical gain[7] or perhaps program a computer to do it for you. In this way, you could find out what the beam should do under certain conditions. What I wanted to know was what *would* the beam do under *actual* conditions. The only way to find this out is to call CQ DX and see from what direction your answers come. Then instantly switch back and forth between the beam and a fixed reference dipole and a reference ¼-wave ground plane antenna and request the DX station to give you comparative reports on the three antennas.

As a general rule of thumb, the gain of a beam increases by about 3 dB when you double its size. *The ARRL Antenna Handbook*[8] states that a 3-element phased endfire beam has an average gain of 5 dB depending on several variables, while a 6-element beam has a gain of 8 dB. In an attempt to measure the gain of our new array with a home-made field-strength meter with a remote indicating meter, we got a gain figure of 12 dB.[9] In a test with W1PFB/mobile on a hill 20 miles away in Vermont on a bearing of 270 degrees, Glen reported the array was S-9, the Hustler 4BTV was S-4, and the dipole was S-2. At six dB per S-unit, this looks like a 30 dB gain, 1,000 times in power; well, you know how S-meters are. The average VK and ZL station, however, also reports the array 3 to 5 S-units better than the two reference antennas. The proof of the pudding is in the high percentage (about 95%) of answers to CQ DX that come from VK, ZL, and other southwest Pacific Ocean areas.

A possible explanation for the reports of 20- to 30-dB gain at a distance of 10,000 miles from an antenna that should only have a gain of 9 dB is that perhaps its angle of radiation exactly matches the angle of propagation for that distance and that the angles of radiation of the 4BTV and the dipole do not. *The Handbook*[10] states in Table 1, p. 18, that at 14 MHz, signals arrive 99% of the time at between 6 degrees and 17 degrees and

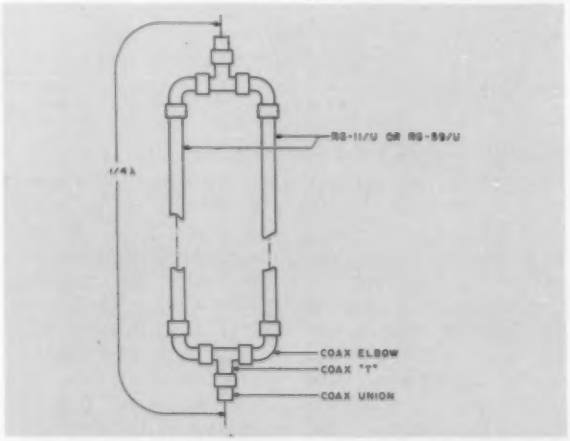


Fig. 5. 37.5-Ohm Q transformer—converts 25 Ohms to 56 Ohms.

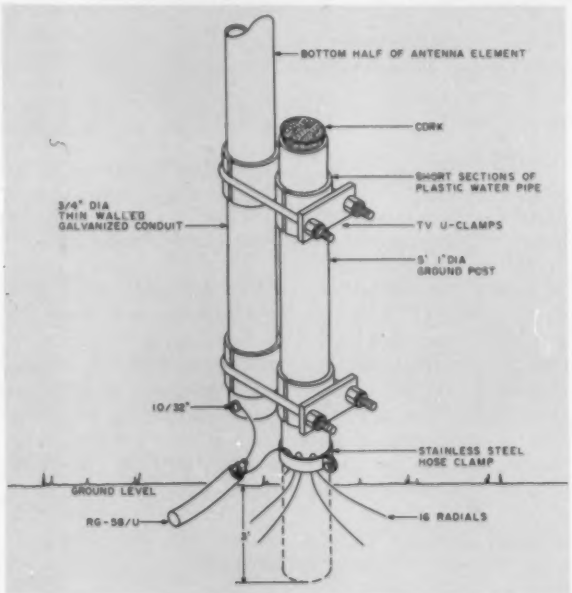


Fig. 6.

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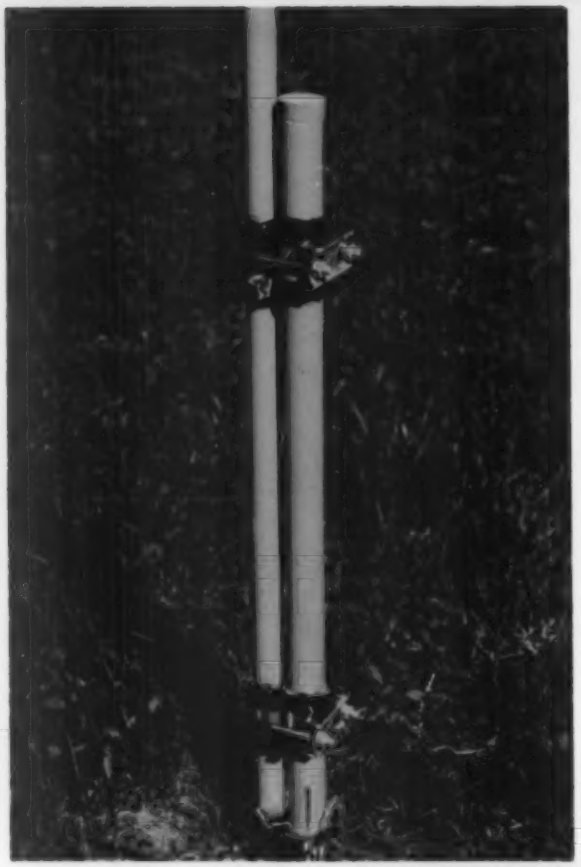

Each of the eight elements is attached to its ground post as shown, using split sections of plastic water pipe for insulators held in place with mylar™ electrical tape and clamped together with TV U-clamps. Refer to Fig. 6.

arrive 50% of the time between 6 and 11 degrees. It is also pointed out that since the maximum single hop via the F2 layer is 2500 miles,[11] a signal traveling from New Hampshire to Australia, 10,000 miles, would require a minimum of four hops. A signal radiated from a dipole ½ of a wave high would have a pattern like that in Fig. 9, with most of its power being radiated at an angle of 28 degrees. It would, therefore, require more hops to reach Australia, and since each hop attenuates the signal, it might be several S-units weaker than the array, thus accounting for the discrepancy in the gain figures between the array and the dipole.

Fig. 10 shows the vertical radiation of a vertical dipole with its center ¼ of a wave above ground. It is believed that a ¼-wave ground plane would have a similar pattern. Note that the effect of ground attenuation absorbs most of the radiation below 10 degrees. My 4BTV has 16 ¼-wave radials, more than usually used, but far less than the recommended 40 radials, each 0.4 of a wavelength long. Therefore, it may have a higher angle of radiation than the array and take one or two extra hops to reach Australia. Thus, with the ground attenuation and the extra hops, it might be even weaker than the dipole, and it appears to be. This same phenomenon, of course, also applies to rotary beams. For example, three identical beams with a gain of 8 dB will each exhibit completely different gains at a point 10,000 miles away, depending on the height at which they are mounted. The one exactly ½ of a wave above ground will be the weakest, the one 1 wave above ground will be an S-unit or so stronger, while the one 1½ waves high will be by far the strongest. At 2500 miles, however, they may be all equal.

Over a three-month period, more than 150 VKs and ZLs were worked, many of whom could not even be heard on the 4BTV or the dipole. QRM from the west is louder, of course, because the array points that way; however, most of these stations are still asleep at 6:00 am Eastern Time. The side-to-front and front-to-back ratios must be fairly good because QRM from Europe and South America is rarely a problem.

If you already have a quad at 60 to 100 feet, this array will not help you. If, on the other hand, you only have a tribander at 35 feet, you may do better in one direction with this phased array, saving the cost of a taller tower. If you are considering spending a bundle for a 60-foot tower and rotatable beam, you may do well to consider two or three of these arrays, each pointing toward needed new countries. Your ability to instantly switch direction with several of these arrays without waiting for a cumbersome rotary beam to turn is indeed a new experience in DXing.

This array, with its method of phasing and power division, may be scaled to other amateur bands. It is possible that top-hat loaded elements could be used on 80 and 40 to keep the height down to 16 feet.[12]

The directional characteristics, both horizontal

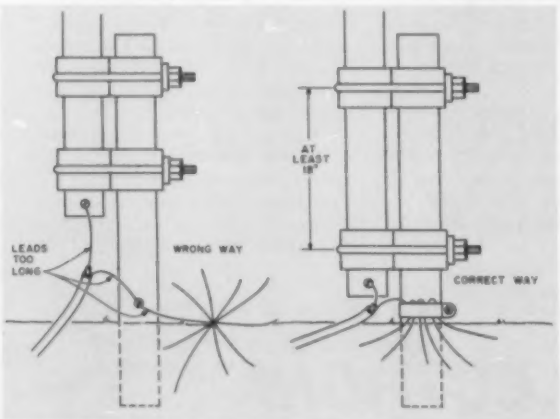

Fig. 7. Right and wrong ways of connecting radial system.

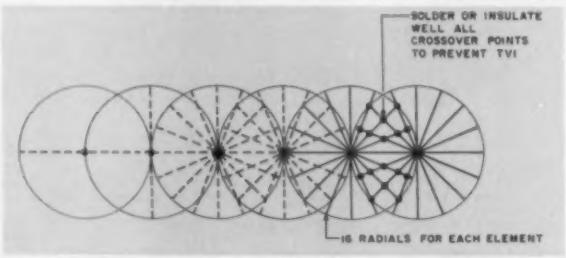

Fig. 8. Radial system shown in full for first two elements on the right. The other six are identical.

and vertical, of antenna arrays similar to the one discussed in this article may be found in various handbooks.[13]

The direction of radiation of this array may be switched end-for-end or broadside by bringing equal lengths of RG-58/U from each element into the shack to eight single-pole, three-position coaxial switches. Three different phasing harnesses would be switched into circuit.

Operation of the Array on 21 and 28 MHz

Recently, during a 10 meter band opening, I decided to check the swr of the 4BTV vertical on 28 MHz, and, to my surprise, it was 1:1. I was more surprised to find that the coaxial switch was in the 20 meter array position, not the 4BTV position. Further measurements showed the swr of the array on 10 meters to be as shown in Fig. 11. Next, the swr was measured on 21 MHz. These figures indicate that the array should work on both 10 and 15 meters, and indeed it does. On 10 meters, the swr is 1:1 around 28.5 MHz and is below 1.5:1 from 28.1 to 28.8 MHz as shown. On 15 meters, the swr is 1.3:1 at 21.150 and is below 1.7:1 from 21 to 21.450 MHz. Listening and transmitting tests confirmed that on the ten meter band the directivity was essentially the same as that on the 20 meter band. Signals from the west peaked up a couple of S-units, while signals from the south and northeast fell off a couple of S-units compared to the 4BTV and the dipole. On 21 MHz, the directivity was less pronounced, but the array proved to be effective, equal to or better than the 4BTV or dipole in the westerly direction.

Four more radials were added after this picture was taken, making a total of sixteen; all were from 16 to 20 feet in length. The author employed a trained mole; however, any sharp-pointed garden-weeding or cultivating tool may be used to scratch the shallow trench needed to bury the radial about 1 inch. Refer to Fig. 8.

Why does a 20 meter array work on 15 and 10 meters? Terman[7] states that an endfire array consists of identical antennas arranged along a line carrying equal currents excited so that there is a progressive phase difference between adjacent antennas equal in cycles to the spacing between these antennas in wavelength. He further states that the gain of the array is proportional to the length of the array, but is independent of the spacing of the elements provided that the spacing does not exceed a critical value of about 3/8 wavelength. Greater spacing is permissible under certain conditions. The array being described fulfills the above conditions on 14 MHz with a 90-degree phase lag and ¼-wave element spacing. On 21 MHz, using the same phasing harness, the phase lag becomes 135 degrees with the 3/8-wave spacing between elements. On 28 MHz, we have a 180-degree phase lag with ½-wave spacing. In other words, the phase lag between elements is correct for the element spacing on each of the three bands. The element lengths, however, are incorrect on 21 and 28 MHz. On 21 MHz, the elements are 3/8 of a wave long, as are the ¼-wave Q transformers. It is not quite clear why it works as well as it does on 15 meters. On

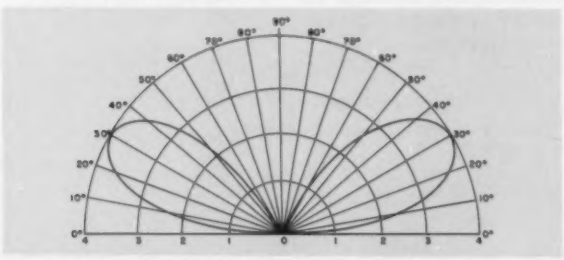

Fig. 9. Vertical angle of radiation of a half-wave dipole at a height of ½-wave above a perfectly conducting ground.

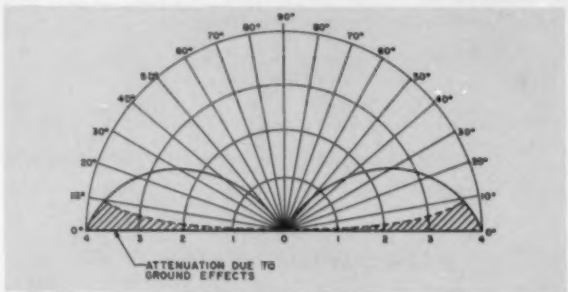

Fig. 10. Vertical angle of radiation from a half-wave vertical antenna whose center is ¼-wave above a perfectly conducting ground.

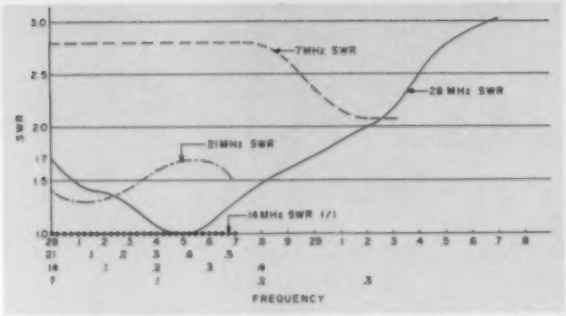

Fig. 11. Swr curves for 7 MHz through 28 MHz for the array.

28 MHz, where the elements are ⅓ of a wave long, it would appear that we are trying to feed a high impedance point with a low impedance feeder. There is undoubtedly a very high swr on the coax nearest to the elements. The losses will be low since the coax is short. Since our ¼-wave Q transformers are now ⅓ of a wave long, they no longer act as Q transformers but simply repeat the impedance from one end to the other. At each "T", we parallel these impedances and cut them in half, thus reducing the swr as we get nearer to the transmitter. Terman shows that the gain with ½-wave spacing is only about ½ that of ¼-wave spacing; however, since the array on 10 meters is twice as long as it is on 20 meters, the gain doubles and therefore is about the same as on 14 MHz.

P.S. It works like a bomb on CB. ■

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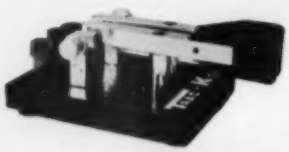

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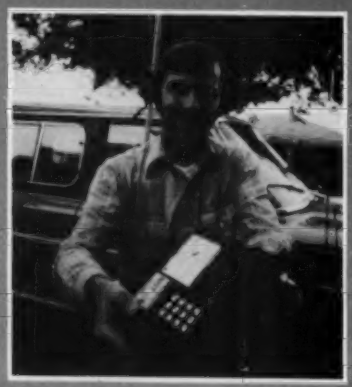
While on my last hunt (which was a first place by the way) I had dropped the radio out of my Jeep Cherokee while getting out to find the fox. I didn't realize that I had done so until we were leaving the area in which they were hiding. Well the fox was hid deep in the woods, and the ground was very muddy, and all the other four wheel drive vehicles were on the way to the spot where I thought that the radio might have dropped. So we raced back to the spot, to find that the radio was run over by a seven thousand pound truck and mashed into the ground! Now this might have been a real catastrophe, but the radio was still in working order. One of the other hunters had found the radio just before I had arrived on the scene and thought that the sound coming from the ground was the fox!

Well as you can see, the only real damage is to the case, and my self-installed tone pad has expired. So thanks for making a tough little radio, and keep up the good work.

Sincerely,

Paul J. Mayer, Jr.
WB9ZHG



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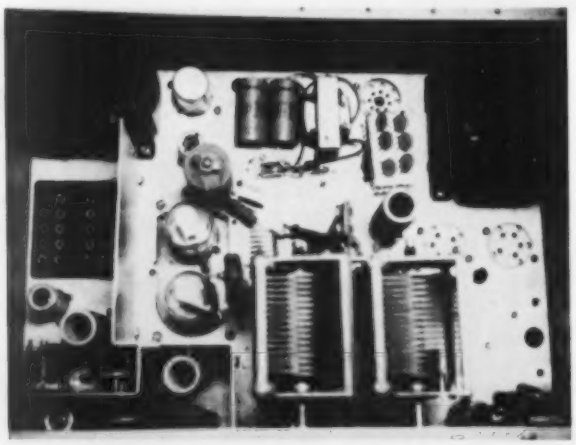
CW with a Nordic Flair

—new life for the Viking I

Butcher your boat anchor.

For the CW op who is looking for a respectable signal with minimum cash outlay, here's a chance to put a quarter kilo on the bands for about two bits per Watt.

The recipe for this treat has, as its main ingredient, one of the old boat anchors that were "in" before the advent of the filamentless tube. We refer to rigs in the Viking class which can be acquired at hamfests for anywhere from $30 to $100. Prices generally are inversely proportional to the algae accumulation, that is, the more shine outside, the higher and bigger the ticket. I can only encourage prospective buyers not to worry about outside rust, dents, and scratches, but rather to get a close evaluation of the innards, mainly the power transformers and rf section.



When I acquired a Viking I, the cost of the rig was less than the follow-up chiropractic costs from hefting this unmobile monster. So, numero uno for the mod squad was a requirement to trim, slim, and debulk the critter. If you have a Viking, compare it with the photograph which shows a lot of gaping space left when we retired from surgery.

I don't have any "remove the third bolt and cut the green and white wire three inches from the end" type of description for these mods. But take heart and use judgment and a certain amount of caution. It's your rig to butcher as you bloody well please, so you're the only judge of what you do. An old friend used to assay his home jobs in two categories—for fun or for sell. You won't have much of a shot at selling it, except on performance, so have fun like I did.

Check the circuit of the unmodified power supply. There are really a powerful lot of iron components floating around, iron that means good design but is not really needed in a strictly CW machine.

Transformers T1 and T2 are needed, of course. But chokes L1 and L2 were promptly relegated to the junk box (which is one way to build up one of those junk boxes that builders always seem to have). These chokes serve to smooth out the ripple in the outputs of their respective power supplies. You learned about them studying for the General exam without getting involved with more complicated stuff like $E = L\ (di/dt)$, which has to do with the notion that a changing cur-

rent through an inductor causes a back electromotive force (emf). The back emf tends to oppose the change in voltage trying to take place, with the net effect that one tends to cancel the other, particularly when load demands change, as in modulation. So, instead of a changing voltage at the rectifier output (a ripple), you get a smoother dc voltage, which is why it's called a smoothing choke.

Those chokes are fine for ten meter phone rigs, but, since this is a CW rig, we care less about phone and don't need the super design of smoothing chokes to get a T9 report.

But something is needed in there to work with the filter capacitor, which turns out to be a series resistor. L1 was replaced with a 200-Ohm, 50-Watt resistor, and L2 with a 500-Ohm, 25-Watter.

From there, I moved over to the audio section, and, in a flash, two more big hunks of iron, T3 and T4, passed on to the junk box, probably never to rise again, since these are the modulation and interstage transformers.

Right about there is where paring the iron takes some steely nerves, because it's a no-return point. Those transformers go and so does any phone mode. You could always sit back and rationalize that you just might like to take a whack at AM some day and all that. Well, that's your decision.

Without the transformers, there wasn't much sense in leaving the audio tubes in their sockets, so out they came, at a saving of 15 Watts of filament power.

Meanwhile, back at the power supplies, further mods were made. It was with some pleasure that I relegated the rectifier tubes V8, V9, and V10 to the junk box, saving another 30 Watts in filament power. Solid-state rectifiers were installed.

The low-voltage power supply was converted quite simply with a plug-in replacement, the 1N2389. But you don't have to go to that expense. Use a pair of diodes in a full-wave circuit from the *Handbook*. Type 1N4006 diodes rated at 800 volts, 1 Amp, are advertised at 15 cents each. Buy a bunch and run some front-back resistance measurements to select the best with the highest back resistance.

I went to a three-diode series arrangement shown in the diagram, using three of the 1N4006s to get a safe peak inverse voltage level of 2400 volts in the high-voltage power supply. The shunt resistors and capacitors are there to protect the diodes in case one of the critters has different characteristics than the others and might take an ungainly bigger slug of peak voltage. That would have you back in there with the soldering iron right soon. The *Handbook* also talks about this situation.

The high-voltage rectifier was built on sandwiched pieces of perfboard and wired to an old tube base (that I happened to have in the junk box) from a discarded 5R4, and that just plugged into the old 5R4 socket.

After all these chops, the net change was to have cut out four chunks of iron and seven hot bottles, which was a significant weight and power reduction. I went back in to add a small 24-volt transformer, rectified with another pair of those 1N4006s, and regulated by a small 15-volt solid-state voltage regulator (Radio Shack has them for $1.50). This supply is intended for a vaguely-distant outboard FET vfo (one of these years). A VR150 was also added to the screen grid of the oscillator, and an antenna relay was thrown in for full break-in.

The first thing I noticed on firing up the rig was a hefty slug of plate voltage, well over 800 volts. Just to bore you a bit as to why there was so much more soup over the nominal

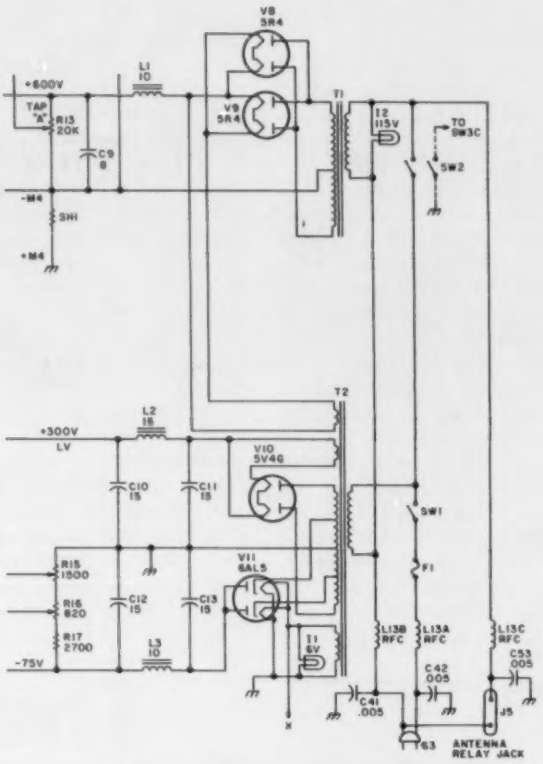


Fig. 1. Original Viking power supply diagram.

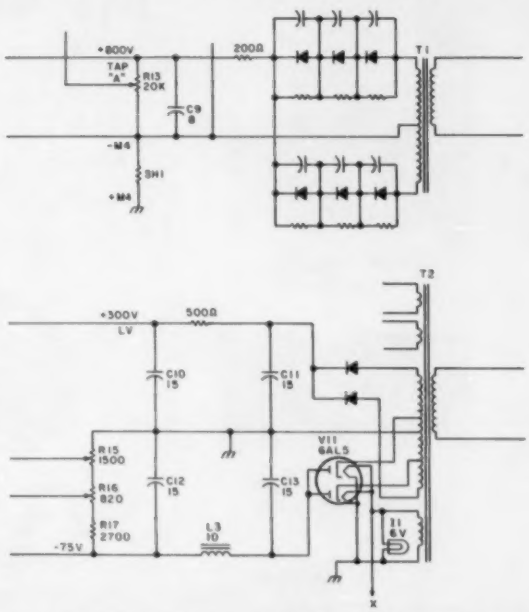


Fig. 2. Modified diagram. Diodes—1N4006s. R—1 meg. C—.01 μF.

600-volt former value, it was the replacement of the vacuum tube rectifier with the more efficient solid-state rectifier. In the theory of vacuum tubes, there is that characteristic known as the tube's dynamic plate resistance. This is a simple cut at Ohm's law, which says that anytime there is voltage across a gadget through which current is flowing, that gadget has a resistance. More properly with respect to a tube, a changing voltage with respect to a changing current gives a changing, or dynamic, resistance. Trouble with the tube is that its dynamic plate resistance can't drop as low during heavy conduction as the semiconductor's can, so the voltage across the tube is voltage wasted. Since the semiconductor doesn't have that kind of hang-up, very little IR drop is across the semiconductor under heavy forward conduction and all the soup goes into the pot, right at the final plates. (Our low value of resistance in the filter also helps.)

Also noticed real quick-like was the way rf zapped around the plate tuning capacitor. There's a lot more rf kicking around the final with higher voltages, and you really have to be careful in tuning. Had I not buttoned up the rig and gotten subsequently sidetracked, the smart addition would have been a switchable resistor in series with the screen grids to the final. I felt bad about this one getting by and strongly recommend breaking the screen lead to insert a 10k or 20k resistor in series with the present dropping resistor. Then put a switch (use the old phone-CW switch) across it so that for tune-up the switch is open and you're in QRP with low screen voltages.

With over 800 volts on the 6146s, you shouldn't walk away with the key down. You could get some experience with cherry red plates by holding the key down for a while (properly loaded) and observing. The rule under such is: red, si; blue, sick. In other words, a cherry red (I don't know why they always say "cherry" red) on the plates won't hurt, but a blue glaze or glow around the envelope when you key is a no-no. It means the tube is gassy and will do unpredictable things. You could get away with using it on 80 and 40, but on 10 or 15 you might well be in trouble (as I was when my blue final brought in a pink QSL once). Best bet is to learn exactly what the dials read when the rig is properly tuned for your antennas on each band, then log those readings. Next time you QSY, go right to those readings before keying down.

The 6146s were loaded to 300 mA with no problems to get that quarter kilowatt. There is occasional arcing, but that's a fun experience that you don't get every day. Fact is, if you had a new checkbook rig and it dared to arc over, you just might have a mild coronary. But with an old clunker like this, what could be more typical ham fun than disturbing the quiet of a pre-dawn QSO with a companionable splat-t-t-t on a long dah. Shucks, that's how you store up memories for the day you join QCWA.

In summary, here's a rig with certain anatomically connotative improvements—it didn't cost an arm and a leg to get a quarter kilo on the air, it doesn't quite break your back to heft it around, and you don't have to sprain your wrist writing out a check for the electric bill. ■

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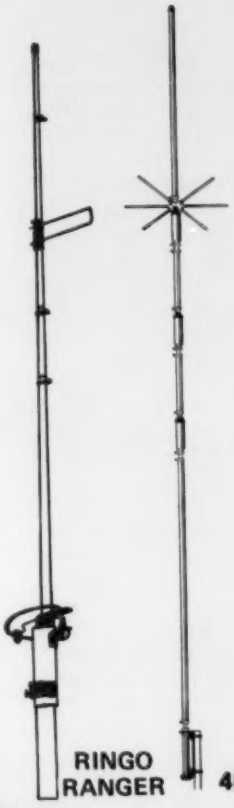

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House-Hunting for Hams

— caveat emptor!

Avoid nasty surprises.

Consider the sad tale I heard on 15 meters the other night.

A ham and his XYL, along with their real estate salesperson, went looking for a new house. In the car, he explained the kind of house he wanted and said that he was looking forward to having his first full-fledged antenna farm. They found the dream house in a fairly new development. He didn't notice any antennas on roofs, but it was early spring and most people had moved in during a long, cold fall and winter. To be safe, they drove by city hall and got a copy of the ordinance pertaining to towers. Everything looked OK. They bought. Months passed. As he was laying out the parts to a 65-foot tower in the backyard, a neighbor casually asked what he was doing.

To his grief, to his agony, he was told that the homeowners association had a rule against all external antennas.

He is not the first ham I, as a real estate broker, have counseled, either on the air or in person, about buying a home. But for him it was too late. He is now reading articles about "cliff-dweller" antennas, and "how to work the world on your attic antenna."

His first reaction, of course, had been, "Can they do that?"

You'd better believe it! In this case, the builder founded the association with the intent of keeping property values at some high common level. It's a great idea for 99% of the people, but for our friend it was tragedy. Buried in the mounds of paper accompanying the normal real estate transfer was a deed restriction giving certain rights to the association regarding the grounds and exteriors of the homes in the subdivision. One rule restricted antennas.

Let's understand one thing right away. There are many ways to get fouled up when buying real property, and new ones are being invented every day. Self-servingly, but realistically, I recommend a trusted broker. You may need to talk with several to find the one you want, but when you do, show your trust by listing the whats and whys of your property needs. Then stay with that broker. He/she will work hard for you and chase information if he knows he'll get paid in the end.

Consider the following in your early discussions with the broker:

1. Homeowners associations. Don't think that townhouses and condominiums are the only places that can restrict you. Many single-family areas of all price ranges have these associations or are attempting to form them. Even the voluntary ones exert peer pressure on non-complying owners. Many times they will have an architectural control committee that can cite you for such things as the wrong color door, a trellis extending above the fence line, or unacceptable installation of children's swing sets. Just try to get them to let you have an 80-foot tribander! I still think associations are a good thing. They do tend to keep values up, and most are reasonable. But I don't know of any allowing what hams dream of.

The listing broker should have information about mandatory or voluntary associations, but if not, your broker can contact the association or its management agent, if there is one.

2. Restrictive covenants (deed restriction or condominium declaration, if any). "Condominium" pertains to a form of ownership law, not architectual arrangements. Many single-family detached homes are coming under the condominium law. I once sold a house that was not under condominium law but had a 1908 deed restriction regarding the size and cost of the outhouse. We found it by checking the records at the county recorder's office. The existing title policy (or other evidence of title in your area) should indicate the existence, but not necessarily the nature, of restrictions. In a subdivision, at least in our area, you can check the documents filed when the division was made and be pretty safe. In non-divided areas, you must check the documents filed on that property.

3. Zoning laws or building ordinances. Most of us are familiar with the battles that hams have had nationwide to keep these laws fair to all. Be care-

ful—just because someone has a tower nearby, or just because one went up recently, does not mean it was legal then or now. Taking down is less fun than putting up.

4. Building permits. In some cases, you may even be required to appear before the town council. You may be restricted as to height, distance from property lines and power lines, and crank-up towers may be allowed only on Tuesdays when the moon is full. That is my way of saying that town councils and those that serve them are very creative when they write laws. The only way to know for sure is to get a copy of the law and ask someone there how they enforce it. You will not find that person in the day you call. In fact, he'll probably be the eighth person you talk with on the tenth day.

Knowing what to look for and being sure are two different things. Start by having a conversation with the broker about your regular home needs. (How about 4 bedrooms, 2½ baths, family room, full basement, 2½ car garage, at least an acre of yard, for not over $35,000? This is a little real estate humor, since that home sells for over $100,000 in our area—but these calls still come.) Then tell about your special needs—some of which will follow. Mention the problems as above. Discuss local areas.

If you are new to the area, contact the ARRL for a list of clubs there. Or get on two meters and find out what the local problems have been from the people who know. But remember, *they* may not be aware of some of the hidden restrictions, unless someone has had a specific problem in that subdivision. (And then, too, some subdivisions have more than one association.)

If you decide you want or need an attorney, find a good *real estate* attorney (the broker can help you). I prefer a local one who knows the area. Get some wherefores and whereas to add to the standard sales contract. They might take the form of a rider making the sale subject to no association, deed restriction, or building/zoning ordinance prohibiting you from doing whatever it is you want to do, or a rider voiding the sale if a building permit to construct (insert what you want) cannot be obtained in some reasonable time. I know many people don't want to spend money for an attorney. Most transactions go rather smoothly for the buyer without an attorney. But on those that don't, it's generally too late for one to help after you find you need one. It's better to get one up front.

Now that you have a broker and attorney working on your behalf, you should monitor their work. Even if you don't understand the law, you can make a judgment about their thoroughness. Ask questions. Remember, they are getting paid to answer your questions. Ask about every aspect of the transaction, not just ham-related ones. If they can't answer, won't answer, or don't try to get the answers, consider someone else.

Here are some more things to check: electrical capacity (verify amperage, but not by counting fuses), wiring (among other things, aluminum wiring was popular at one time and if not installed properly is a fire hazard), elevation (topographical maps, flood plain maps, and elevations-above-sea-level are available through the broker or city hall), power lines (do you really want to live under high-tension lines next to a sub-station?), airports (remember height restrictions), common television antennas (the preamps in these small systems pick you out of the ether better than channel 2), and look for a suitable quiet room away from the family traffic pattern (hi, hi).

One amazing thing I notice about home buyers is that they seldom walk the grounds. Walk all over the yard. Plot antennas as well as geraniums. Get a copy of the survey and plan the future. If the market is fast, the house might be sold before you get that done. Having the attorney prepare safeguards on a rider, prior to looking, gives you the ability to move rapidly even if you are not finished checking everything out. Once you sign, it's too late to ask about towers unless you have caused the contract to give you that right over the next few days.

Perhaps it will never happen to you. Some old deed restriction from a farmer in 1898 won't crop up (did I really write that?), and you'll always luck out, and your only worry will be airplanes dodging your guy wires. Maybe you've bought and sold ten homes and had no problems (Murphy's Law times ten squared), but a little work by you and your broker can make sure you'll get what you want.

Finally, ask about financing. Some of the new plans permit less down payment, but the monthly payment is still affordable. Since less is needed up front, you'll have more available for furnishings such as refrigerators, amplifiers, stoves, transceivers, dishwashers, and so on.

When you get the tower up and have a stacked array on top, give me a call on 15. We can all use the good news! ■

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W2NSD/1
NEVER SAY DIE
editorial by Wayne Green

from page 4

waiter asked me if I was a ham. I nodded and he asked my call. Just to be smart, I tilted my belt buckle up and read the engraved call . . . W2NSD/1. The waiter laughed and introduced himself as Fred Scully WB0FOR.

Since most of us had our HTs with us, Fred clued us in on the repeater in nearby Glenwood Springs . . . 146.67.

The next day, while we were having lunch at the Tiehack restaurant side of Buttermilk Mountain, I tried out my Tempo S1 HT and switched to 67. Sure enough, I raised the repeater and resident user Bob K9MWM. We talked while I ate the delicious pea soup, and then I asked Bob what kind of business he was in out here in a small Colorado town. I just about lost my breath when he said he was writing computer programs for the Radio Shack TRS-80 and selling them to local businesses. It turned out that he reads both *73* and *Kilobaud Microcomputing*. You can be sure that Bob joined us the next day for skiing.

It appears that Instant Software will be able to distribute some of Bob's business programs, so by next year he may have considerably more leisure time for skiing. How many small towns around the country harbor a programmer writing microcomputer business programs? That's just too much of a coincidence.

Sherry Smythe, with all those Aspen trees for which the town is famous in the background.

On the following day, our Denver legal staff drove in and we had a great time spending a full day hashing over growth plans with them. I've long had the desire to take *73 Magazine* public so that the readers would be able to own the magazine, but every time I've approached professionals about this, they have pointed out that it is necessary to have five years of certified bookkeeping before this can be entertained.

Now, with a new corporation (Instant Software, Inc.), perhaps it will be possible, once the corporation shows some significant signs of success, to take it public. Our lawyers seem enthusiastic. It would be fun to be in on the ground floor of something with the growth potential which software publishing seems to provide. Watch out, Xerox!

Between the software, the talks with manufacturers and dealers, the legal discussions, etc., the conference at Aspen was a great success. The skiing was fabulous, the meals ditto, and the company first rate.

Funny thing. I got a beef about the conference last year. One chap showed up with his wife, attended one dinner, and was not heard from again. His employer was bent out of shape at me for this! The purpose of the week-long conference is to get industry people together in a relaxed atmosphere and have ideas discussed on marketing, advertising, the future of amateur radio, etc. Discussions somehow seem to go better when you are on a ski lift together . . . eating lunch on a mountaintop . . . in a sauna . . . or having dinner at a superb restaurant.

While talking over my HT from the center of town, I was stopped by a chap who asked me the repeater frequency for Aspen. It seems that he'd read in *73* about the conference, but his wife wouldn't let him talk with other hams while he was there, so he wasn't checking in with us.

ARRL BLOWS $100,000?

Several of the insiders at the League are bent out of shape over the recent dumping of about 50,000 1978 ARRL *Handbooks*. I gather that the people wanting to blow the whistle first turned to *HR Reports*, but got nowhere. I don't know any good way to check all these allegations out, but perhaps you can get some straight answers from your directors the next time they talk at a hamfest or convention.

It appears that the chap in charge of ordering *Handbooks* made just a little mistake in 1977 when he ordered 30,000 more than the League could sell. No one seems to know just what happened to these 30,000 *Handbooks* or who collected for them.

At least someone seems to have learned by experience, for in 1978 they ordered 50,000 more than they could sell. Now, in the book business, it is not unusual to have some books left over, so publishers send out a letter asking for bids on overstocked books. In this case, where the book was selling for $6 and perhaps selling wholesale for $4, ham stores around the country probably would have jumped to buy out the lot at $3 per book. Since they probably cost around $2 to print, the ARRL still would have come up a winner.

This doesn't seem to have happened. I know that our Radio Bookshop, one of the larger sellers of radio books, never got any word that the *Handbooks* were available . . . and the larger dealers that I have talked with got no word of the brewing deal. What seems to have happened, if I can believe sources within the ARRL, is that some of the *Handbooks* were sold to Herbach and Rademan for $1 each . . . an excellent deal for H&R. The rest of the 50,000 were apparently given to *Ham Radio* magazine to be sold . . . and not for a cash-up-front payment, but on consignment. This means no investment at all for *HR* . . . with the price alleged to be the same $1. Now, if that isn't a sweetheart deal! I think I could have moved the whole 50,000 out to dealers at $3 each on a lovely deal like that.

The end result looks like the ARRL took a bath on the *Handbooks*, losing about $100,000 that they could have netted if they had had anyone with brains running the show. Of course, if there are other factors . . . like a hand under the table somewhere . . . ? And ARRL staffers are still asking what happened to the 30,000 books from 1977 and who got the money for them.

Then there is the case of the missing operating aids. Ten thousand were ordered from the printer and paid for, yet only five thousand were ever delivered. Where did the others go, and who sold them where for how much? I understand that this situation was detected but never investigated. How about asking your directors?

With a hundred thou going here and another there, kind of leaking through the cracks, perhaps it is time for getting rid of the Good Old Boys who are running the HQ and making a mint at it.

Members might ask their directors why they let the same old people run the show when even the old-time staffers are bailing out of the sinking ship. I understand that Bob White left when he was forced out over a DX decision by Baldwin. A lot of years went down the tubes . . . and Bob was about as straight a chap as amateur radio could ask for in the job. His wife apparently left when she could no longer stomach shady doings with new products. So I'm told.

The result of the recent staff changes is that virtually no one on the day-to-day staff has been there more than a couple of years. The pay is poor for the staffers, but they have to put up with what appears to be heavy-duty graft on the part of the Good Old Boys . . . things like having books published by outside publishers using *QST* material . . . trips with a secretary instead of a wife, all paid by the ARRL.

One whistle-blower suggests that I ask for a revelation of who has stock in VBC. The scenario does seem strange . . . first an editorial in *QST* saying that a breakthrough is needed . . . then some articles on NBVM which don't tell how it works, and a 1979 *Handbook* chapter on the system showing a working unit which has never even been shown at HQ. With both the FCC and the communications industry turning thumbs down on the NBVM system, you may be sure that I'll be most interested in how it really works once some units are made and shipped.

I've tried to get some information from the promoter of the effort, Tommy Lott, but have gotten silence for my trouble. This set me to wondering about whether the whole idea was more of a promotion than a breakthrough. It would be comforting to have a disclosure of who owns the stock in the firm and to find that no one at ARRL HQ is listed.

TIME TO SPARE

Recently, I had to make a quick business trip to New York. Having lived in the city for 30 years, off and on, I normally avoid it like the plague that it is. I kept track of the time it took me to get from Peterborough to my destination in Manhattan . . . and I cut things as close as was practical.

I left Peterborough at 0820 and arrived at Logan airport in Boston at 0950. I got right on a

plane and arrived at LaGuardia at 1050. By 1115 I had arrived at the subway station and was on my way to Manhattan. I arrived at my destination at 1200. Now, if I'd driven directly to New York, I'd have arrived at about 1220. I saved 20 minutes and spent a bloody fortune on the plane.

While going past the 61st Street Woodside train stop, I got to thinking back a few years to my visits there with John Williams W2BFD. John died in 1961, and I picked up some of his old equipment at the auction—I still have it around here.

John was the primary pioneer of amateur radio Teletype™. He got going with this back in 1946, and he provided most of the circuits and equipment for the entire hobby for the first few years. John ran this sort of side business out of a grubby little storefront shop in Woodside, Queens ... a radio repair shop. You remember radio? This store, usually closed, made enough for John to support his hobby of RTTY, and that's all he wanted. He designed most of the equipment we used, set the standards, made the templates, sold the parts, and generally nursed this hobby along.

John also got into trouble a lot. Ma Bell was very uptight with him because he had rigged up an automatic telephone-answering device in his store and wouldn't let their inspectors come in to see how he'd done it. They were sure that he was connecting directly to their wires, but couldn't prove it unless they could get in to inspect. They would always find the store closed.

He did indeed connect to the verboten Bell wires and had a corking-good answering system going, years before it was popular. He could talk over the phone from his home a mile away via a carrier current system. The phone-answering system used a phonograph record to give his message and a wire recorder (remember *them*?) to record the response. He was generally monitoring the call from the shop or home and would break in if he wanted to talk with you. You ran into the same problem at the store door ... with an intercom speaker which went via carrier current to his home ... and a similar system at home going to the store. You just were not about to be able to locate John if he didn't want to be located.

I remember the day the FBI came to my house to ask questions about him. That surprised me. All I knew about were his radio repairs, the RTTY involvement, and his problems with Ma Bell, so I couldn't have helped them if I had wanted to. A few years later John confided that he had been involved with a good deal of building and using of bugs, telephone and otherwise, and that this was what the FBI was wanting to know about. He had made a system which the Arabs had put into the Israeli cars in New York to allow them to follow behind and hear what was being said in the cars. I think he also got into telephone modifications which would allow the radio transmission of phone calls over a short distance, a concept which interested the Arabs, too.

The income from these efforts probably went more to keep him going than the radio repairs, as I seldom ever saw him doing any radio repairing. And most of the stuff in his store was RTTY gear, not radios in for repair.

John, with my help, set up the first amateur radio two meter repeater in the country. We set it up on top of the New York municipal building in downtown Manhattan. I will never forget putting up the antenna for the repeater in the middle of the night in a blinding rainstorm—with me up there on a very steep copper roof, holding on to little pegs here and there to keep from falling about 20 stories. I was in my mid-20s at the time and often did silly things like that in the interests of amateur radio.

There was, unfortunately, a slightly crooked side to John, too. I don't know how many hams sent him money for Teletype equipment which he never delivered. It was petty larceny, but aggravating to those of us who knew him and appreciated the extent of his genius. John, at that time, had a virtual corner on all used Teletype gear, so if you didn't buy it from him, you didn't buy it. We were buying Model 12 Teletypes at that time ... somewhere in my barn I have John's old original Model 12, in case there is an opportunity for a shrine to this pioneer to be erected. I also have a couple of the complete W2BFD systems which I built, with auto-start and -stop. They were quite modern, except for the use of dozens of tubes in each one.

Amateur Teletype, when I got interested in it over 30 years ago, was stuck up on two meters (and 11 meters), and we had about 30 stations working all on one frequency in the vicinity of New York. We were on 147.96 MHz using 8220 kHz crystals with SCR-522 systems, for the most part. Using audio frequency shift (2125/2975 Hz), we could leave the receivers on all the time. Our printers would start up if a standard start signal was received ... a couple seconds of mark signal. A steady space signal would turn everything off.

Some of the fellows left their receivers on all the time, while others hooked them into a small clock which sampled the frequency every hour for two minutes. We could then leave messages with anyone by sending the start signal for one minute during this window. I left my receiver on all the time, wanting to keep track of what was happening when I was away from home. I'd come home after a weekend to find a hundred feet of paper on the floor, filled with chit-chat and messages.

A few of the fellows had an automatic confirming system. They put a microswitch behind the Teletype carriage so that it would turn on when the carriage was in one particular position ... say, the tenth letter along. This would turn on the transmitter filaments and warm them up. Then, after a minute in that position, the release of the carrier would trigger a double pulse of the confirming transmitter as a "roger" that the message had indeed been received. Of course it wasn't exactly legal, but then what experimenting is?

Oh, on the repeater, it enabled all of the RTTY hams in greater New York to keep in constant touch and was fantastic. The FCC put it off the air after a few months. They didn't like any automatic relay systems like that. If we could have an operator present, OK, but otherwise, no go.

It was RTTY that got me into this whole ham publishing mess. I started out in 1951 with a monthly newsletter to RTTY hobbyists ... now look at it!

GRABBING THE BUS

One of the more innovative concepts which microcomputers have introduced is the idea of using a bus structure for electronic circuits. In the case of computers, this means that all of the significant signals are made available to every board

John Williams W2BFD, on the left, about 1954. I forgot the chap in the middle, but the right-hand chap is Doc W2BIV, a Brooklyn dentist.

John again, taken during a RTTY meeting about 1954. We'd often get a dozen or more RTTYers out to these meetings.

plugged into the bus. The board can then avail itself of any needed signals with no further interconnections needed.

Could such a concept be adapted to the ham transceiver? Well, let's suppose we wanted to build our system in a modular way and then make any needed connections for accessories available via a bus. We might have on the bus the +5 volts for logic circuits, +12 for control and power circuits, audio for earphones, audio for speaker, mike input, i-f input, i-f output, local oscillator, AVC line, etc.

With that array of signals available for accessories, we could design boards for interfacing SSTV, for RTTY, for CW encoding or decoding, for audio filters, a flying noise lock, synchronous detection, a keyer with memory, VOX, automatic ID, a panadaptor, an autocall unit, programmed tuning, a phone patch, a voice processor, a cassette recorder, a two-tone test, a CW regenerator, etc. There are many possibilities which such a flexible situation would open up for the super transceiver of the future.

This type of structure would make it possible to buy a barebones transceiver and then add plug-in modules as money and technology permit. It would make it possible for the CW fan to get any bandwidth i-f desired, add audio filters, a regenerator, and end up with an incredible CW receiver. The weak-signal VHF CW experimenter could narrow down the i-fs, put in the filters, a flying noise lock, a recorder, and all those things which this strange craft requires.

The Saturday afternoon ragchewer could have his system monitor any set of channels for calls from friends, all done automatically ... complete with a beeper alerting call on a VHF band, if wanted.

How much further would such a system have to be pushed to decode CW signals and look for expected DX? No strain ... and the next step, with such a structured system, would be automatic DXing.

AUTHOR PREROGATIVES

One of the publisher's newsletters mentioned that writers can charge off magazine subscriptions as a business expense. That makes sense ... and might be just another reason to become a professional writer for the ham magazines ... such as *73*.

As a professional writer, your expenses would include the cost of any equipment you have built or reviewed ... costs of your writing office, reference works, test equipment, etc. It's worth checking out with your tax accountant.

What kind of articles are we looking for at *73*? First choice goes to state-of-the-art projects ... perhaps a microprocessor-run something hammy ... small and medium construction projects are always popular. It's difficult to get too much in the way of home-built equipment articles, antenna articles, microcomputer articles ... just about anything on new techniques and modes. We need more on satellite equipment and techniques ... AM on ten meters ... new RTTY equipment ... even very low frequency articles are of interest.

I'm always on the watch for any really hot new aspect of amateur radio which I might be able to use to get thousands of amateurs interested and involved. Look what happened when I plugged the devil out of two meter FM and repeaters! This can be done again if something with good possibilities comes along ... so if you think you've got it, please start writing and let's see if it flies.

Writing for *73* isn't very difficult. Remember to double space your typing (please type it), do not use all capital letters, and get me the very best pictures you can.

WEIGHTY MATTER

There are, I understand, several dozen *73* readers who have no problem with their weight ... and possibly a few of those with wives with no concern about weight, though this seems unlikely. What this all comes down to is dieting ... at least every now and then. Erma Bombeck classifies "diet" as one of the dirty four-letter words, and I tend to agree with her.

Heath has come out with a very nice electronic scale (the GD-1186) for the bionic people. It reads to a tenth of a pound, which is fabulous for dieters. Most of us serious dieters long ago shifted to what are known as doctor scales. These monstrosities are accurate down to a quarter of a pound and are excellent because they tend to give very fast reinforcement to even the first day's dieting ... when it is needed the most.

The Heath scale is small ... about a foot square, if you'll pardon the expression ... and 7" high for the readout. It's light enough so you can even take it with you on trips and make your life miserable after every fantastic meal.

Like all other Heath stuff, this comes in kit form. Figure on one good evening to put it together. It's relatively simple, and no one but me could stretch one evening's work out over a couple months ... 99.9% of which was pure neglect. Now that it's done, I don't know how I got along without it.

Like many of you, I am an incipient fat person. I have all the bad traits of a fat person ... like eating because the food is there, with little relationship to any signs of hunger. I love things with butter or rich sauces, and can easily list over 500 deserts which are tops with me. Only by doing my best to keep my breakfasts and lunches simple am I able to avoid zooming up to over 250 pounds ... a weight which I have managed to attain in the past.

It's very difficult to seriously diet when I'm eating out. After all, I'm paying for the damned food, so why not eat it? So I cram down as much as I can of everything, making sure that I do my best to get my money's worth. And if I can't get it down the old hatch, it goes into a doggy bag for tomorrow night. I don't have a dog.

All this got a little out of belt a couple of years ago, so both Sherry and I started cutting down. These days, we generally order one meal between us and still end up with something to take home ... particularly if there is a salad bar. But this still calls for a careful watching of the scales at home ... and the Heath is absolutely wonderful for that. The tenth-pound readout makes it immediately apparent when I've snacked too much.

One of the better snack cutters I've found of late has been the VTR video recorder. With this system, as I've mentioned before, virtually all TV programs I watch are recorded so that I can see them without the commercials. Otherwise, I find myself getting up, wandering around, looking for something to eat during the breaks ... heck, a cup of coffee and some cookies wouldn't hurt much ... perhaps a tenth of a pound. Maybe some nuts and fruit? Better to get up and fast-forward the VTR and not snack. Then there is more to see of interest on the Heath scale in the morning.

The Heath scale would make a great present for the XYL for her birthday, Mother's Day, etc. And it would be something you put together for her. It costs $99.95, which is a very good buy compared to the much less accurate doctor's scales.

DECEMBER WINNER

Johnny C. Chestnut WA4PIN and John L. Wolcott W4CCX will each be receiving a $50 bonus prize for authoring December's most popular article, "The Lunch Counter." Remember, your ballot is your Reader Service card.

This ambulance is at the ready to cart away hams who totally lose control over the low prices at Tufts Electronics. They get a free trip to the foam-rubber room of the local funny farm until they are signed out by their wives.

Ham Help

I would like to hear from anyone who has converted a 23-channel CB Cobra Camm 88 for use on the 10 meter band, for either the Novice Tech CW portion or for the phone portion of the band.

Berand (Henry) Kirschner
WB9YCQ
12756 Newport Ave., Apt. C
Tustin CA 92680

Will anyone living in the San Diego, California, area volunteer to administer the Novice exam to a fine young man? His name and address: Mike Batson, 1539 Motor Way, San Diego CA 92145; (714)-566-2910.

Robert D. Cummings
U.S. Navy PEP DET Netherlands
c/o U.S. Embassy
APO NY 09159

Microcomputer Interfacing

from page 24

terrupt to the microcomputer. Some real-time clocks are free-running, always keeping time. Others are programmable or preset for a particular period. The free-running clock interrupts the computer at repetitive intervals, while the programmable clock interrupts the computer only once, at the end of its preprogrammed period. Integrated circuits such as the Intel 8253 and Texas Instruments TMS 5501 contain time-keeping circuitry which is easily interfaced to most 8080 systems.

For simplicity, we will use the software clock in our example rather than an interrupt-based real-time clock. The software for the 100-point data acquisition program is shown in Table 2. After completing the program, the computer might be programmed to jump to the type of data display software discussed previously. If you look at the program carefully, you will not find a separate register used to count the 100 passes through the data acquisition software. Since the memory address stored in registers H and L is already a counter, we have chosen to detect the 200th address rather than the 100th loop. This saves an internal register. Instead of decrementing a counter and detecting the zero condition, the contents of register L are compared to the final address and equality is used to signal the end of the loop.

Analog-to-digital converters are not "instantaneous" devices which take only a few microseconds to perform a conversion. In many real situations, the analog input to the converter will vary while the ADC is trying to perform a conversion. This presents the converter with a problem. How does it know what the real value of the voltage is? In most systems, the ADC module has a *sample-and-hold* (SH) on the analog input. The SH circuitry samples the analog voltage when pulsed to provide a steady analog output to the ADC for conversion; the ADC is then pulsed to start the conversion. The Intersil IH 5110 is a typical sample-and-hold device.

OSCAR Orbits

Courtesy of AMSAT

The listed data tells you the time and place that OSCAR 7 and OSCAR 8 cross the equator in an ascending orbit for the first time each day. To calculate successive OSCAR 7 orbits, make a list of the first orbit number and the next twelve orbits for that day. List the time of the first orbit. Each successive orbit is 115 minutes later (two hours less five minutes). The chart gives the longitude of the day's first ascending (northbound) equatorial crossing. Add 29° for each succeeding orbit. When OSCAR is ascending on the other side of the world from you, it will descend over you. To find the equatorial descending longitude, subtract 166° from the ascending longitude. To find the time OSCAR 7 passes the North Pole, add 29 minutes to the time it passes the equator. You should be able to hear OSCAR 7 when it is within 45 degrees of you. The easiest way to determine if OSCAR is above the horizon (and thus within range) at your location is to take a globe and draw a circle with a radius of 2450 miles (4000 kilometers) from your QTH. If OSCAR passes above that circle, you should be able to hear it. If it passes right overhead, you should hear it for about 24 minutes total. OSCAR 7 will pass an imaginary line drawn from San Francisco to Norfolk about 12 minutes after passing the equator. Add about a minute for each 200 miles that you live north of this line. If OSCAR passes 15° east or west of you, add another minute; at 30°, three minutes; at 45°, ten minutes. Mode A: 145.85-.95 MHz uplink, 29.4-29.5 MHz downlink, beacon at 29.502 MHz. Mode B: 432.125-.175 MHz uplink, 145.975-.925 MHz downlink, beacon at 145.972 MHz.

OSCAR 8 calculations are similar to those for OSCAR 7, with some important exceptions. Instead of making 13 orbits each day, OSCAR 8 makes 14 orbits during each 24-hour period. The orbital period of OSCAR 8 is therefore somewhat shorter: 103 minutes.

To calculate successive OSCAR 8 orbits, make a list of the first orbit number (from the OSCAR 8 chart) and the next thirteen orbits for that day. List the time of the first orbit. Each successive orbit is then 103 minutes later. The chart gives the longitude of the day's first ascending equatorial crossing. Add 26° for each succeeding orbit. To find the time OSCAR 8 passes the North Pole, add 26 minutes to the time it crosses the equator. OSCAR 8 will cross the imaginary San Francisco-to-Norfolk line about 11 minutes after crossing the equator. Mode A: 145.85-.95 MHz uplink, 29.4-29.50 MHz downlink, beacon at 29.40 MHz. Mode J: 145.90-146.00 MHz uplink, 435.20-435.10 MHz downlink, beacon on 435.090 MHz.

Oscar 7 Orbital Information

Orbit	Date (Apr)	Time (GMT)	Longitude of Eq. Crossing °W
20011	1	0024:32	68.4
20024qrp	2	0118:49	82.0
20036	3	0018:09	66.9
20049X	4	0112:26	80.5
20061	5	0011:47	65.3
20074	6	0108:04	78.9
20086	7	0005:24	63.8
20099	8	0059:41	77.3
20112qrp	9	0153:58	90.9
20124	10	0053:18	75.8
20137X	11	0147:35	89.4
20149	12	0046:55	74.2
20162	13	0141:12	87.8
20174X	14	0040:33	72.7
20187	15	0134:50	86.2
20199qrp	16	0034:10	71.1
20212	17	0128:27	84.7
20224X	18	0027:47	69.5
20237	19	0122:04	83.1
20249	20	0021:24	68.0
20262	21	0115:41	81.6
20274	22	0015:02	66.4
20287qrp	23	0109:19	80.0
20299	24	0008:39	64.9
20312X	25	0102:56	78.4
20324	26	0002:16	63.3
20337	27	0056:33	76.9
20350	28	0150:50	90.5
20362	29	0050:11	75.3
20375qrp	30	0144:27	88.9

Oscar 8 Orbital Information

Orbit	Date (Apr)	Time (GMT)	Longitude of Eq. Crossing °W
5459Jbn	1	0130:21	66.0
5473Abn	2	0135:19	67.3
5487Abn	3	0140:31	68.7
5500X	4	0002:29	44.2
5514Abn	5	0007:40	45.5
5528Abn	6	0012:52	46.8
5542Jbn	7	0018:03	48.1
5556Jbn	8	0023:14	49.4
5570Abn	9	0028:26	50.7
5584Abn	10	0033:37	52.0
5598X	11	0038:49	53.3
5612Abn	12	0044:00	54.7
5626Abn	13	0049:12	56.0
5640Jbn	14	0054:23	57.3
5654Jbn	15	0059:34	58.6
5668Abn	16	0104:46	59.9
5682Abn	17	0109:57	61.2
5696X	18	0115:08	62.5
5710Abn	19	0120:20	63.8
5724Abn	20	0125:31	65.2
5738Jbn	21	0130:42	66.5
5752Jbn	22	0135:53	67.8
5766Abn	23	0141:05	69.1
5779Abn	24	0003:02	44.8
5793X	25	0008:13	45.9
5807Abn	26	0013:25	47.2
5821Abn	27	0018:36	48.5
5835Jbn	28	0023:47	49.8
5849Jbn	29	0028:58	51.2
5863Abn	30	0034:09	52.5

Corrections

A reader, Wilbur Stevens, was nice enough to point out an error in "Build a $10 Digital Thermometer" (January, 1979). In Fig. 4, on page 54, the values on the pots are reversed.

Gary McClellan
La Habra CA

Thank you for printing my OM's story about CW music ("This Station Plays Beautiful CW") in the February issue of *73*. His secretary and I both appreciate the celebration dinner made possible by the author's fee.

Nevertheless, I would like to caution the XYLs of your readers who may build a keyboard. While the diode matrix is so simple that the OM can make the hookup "while the XYL is talking," it does not necessarily follow that the OM will hear what the XYL is saying. Further, if the impasse reaches the point where not even an "uh huh" is expressed, the XYL should step up and point out that there is an error in Fig. 1. Each bus (K_0-K_7) is fed through a 10k resistor which is not shorted out as the schematic indicates.

It is a worthwhile project because, after it is completed, the XYL can carry on a CW conversation with other XYLs. All that is necessary is to use the OMs as interfaces between headsets and conventional typewriters. This will suffice until WB9WRE completes his low-cost CW typewriter.

Jean Crom
XYL of WB9WRE
Mt. Prospect IL

Ham Help

I need the schematic for a Fukuyama Multi-7 (FDK) 2m FM Radio, as well as the alignment procedure. Can anyone help?

N. W. Zimmerman W7MAF
1815-17th Ave. So.
Great Falls MT 59405

I need the schematic of a Dage model 6SA-3 TV camera (or of a similar tube-type model) manufactured by Dage.

James M. Zacher
15 W. Cypress
Arlington Hts IL 60005

Social Events

from page 39

and flyers, contact Richard Spahl K1SYI at (617)-943-4420 after 8:00 pm.

TRENTON TN
MAY 20

The Humboldt ARC will hold its annual hamfest on Sunday, May 20, 1979, at Shady Acres City Park, Trenton, Tennessee. There will be a flea market, prizes, ladies' activities, and food. For further information, contact Ed Holmes W4IGW, 501 N. 18th Ave., Humboldt TN 38343.

BURLINGTON KY
MAY 20

The Kentucky Ham-O-Rama will be held on May 20, 1979, at the Boone County Fairgrounds, Burlington, Kentucky. For easy access, take the Burlington exit off I-75 south. There will be a chance for prizes included with the $3.00 gate ticket. There will also be hourly drawings, exhibits, a flea market, and refreshments. Talk-in on 146.19/79 and 52/52. For more information, contact NKARC, Box 31, Ft. Mitchell KY 41017.

EASTON MD
MAY 20

The fifth annual Easton Amateur Radio Society Hamfest will be held on May 20, 1979, from 10:00 am to 4:00 pm, at the Easton Senior High School cafetorium on Rt. 50, just south of Easton at mile marker 66. From the Baltimore or DC areas, go across the Chesapeake Bay bridge; the mile marker is about 27 miles from the bridge. There will be hamfest signs on Rt. 50, north and south. Refreshments will be available. There will be a donation of $2.00 with an additional $2.00 for tables or tailgaters. Talk-in on 52 and 146.445/147.045. For more information, write Charles C. Walgren WA3ZWX, Box 7, Trappe MD 21673, or the Easton Amateur Radio Society, Inc., Box 781, Easton MD 21601.

HAMBURG PA
MAY 27

The Reading Radio Club will hold its annual hamfest on Sunday, May 27, 1979, beginning at 9:00 am, at the Hamburg Field House in Hamburg, Pennsylvania. There will be door prizes, food, tailgate sales, and dealer space available. The hamfest will be held rain or shine. Talk-in on .31/.91 and 146.52. For more information, write The Reading Radio Club, Hamfest Committee, PO Box 124, Reading PA 19603.

UPPER HUTT NZ
JUN 1-4

The 1979 Annual Conference of the New Zealand Association of Radio Transmitters will be held on June 1-4, 1979, at Upper Hutt, New Zealand. Visitors are welcome to attend this conference. For registration forms, contact the Secretary, 1979 Conference Committee, PO Box 40-212, Upper Hutt NZ.

WEST HUNTINGTON WV
JUN 3

The Tri-State ARA will hold its 17th annual hamfest and family picnic on June 3, 1979, starting at 10:00 am, at the Camden Amusement Park, West Huntington, West Virginia. There will be a planned program for the XYL and kids, or you can enjoy the amusement park if you prefer. There is a possibility the FCC will administer amateur exams. There will be major prizes, a large flea market, exhibitors, and displays. Dealers are always welcome to space in the covered pavilion. Talk-in on 34/94 or 16/76. For more information, write TARA, PO Box 1295, Huntington WV 25715.

MANASSAS VA
JUN 3

The Ole Virginia Hams A.R.C., Inc., will hold the Manassas Hamfest on Sunday, June 3, 1979, at the Prince William County Fairgrounds, ½ mile south of Manassas, Virginia, on Route 234. There will be indoor and outdoor exhibit areas, dealers and manufacturers, and tailgaters. Also included will be plenty of parking, prizes, an FM clinic, breakfast and lunch, a YL program, and children's entertainment.

PRINCETON IL
JUN 3

The Starved Rock Radio Club will hold its annual hamfest on Sunday, June 3, 1979, at the Bureau County Fairgrounds, Princeton, Illinois. The fairgrounds are centrally located and easily reached via routes 80-6-34-89-26. Watch for the large yellow "Hamfest" signs. There will be lots of room for the free swappers' area and parking. New equipment dealers, manufacturers, and their representatives are invited to request details on reserving space in our inside display area. There will be food and refreshments available during the day. Camper, van, and trailer spaces are available for a nominal fee and should be reserved in advance. Please include an SASE for map, motel information, and advance reservations at $1.50, if postmarked before May 20 ($2.00 at the gate). For more information, write W9MKS/WR9AFG, Starved Rock Radio Club, RFD #1, Box 171, Oglesby IL 61348, or phone (815)-667-4614.

GUELPH ONT CAN
JUN 9

The Central Ontario Amateur Radio Flea Market will be held on Saturday, June 9, 1979, from 8:00 am until 4:00 pm at Centennial Arena, College Ave. W., Guelph, Ontario, Canada. Commercial displays will open at 10:00 am. Admission is 75¢ per person with children 12 years and under admitted free. Admission for vendors is an additional $2.00. There will be a large indoor and outdoor flea market, commercial exhibits, free balloons, free handouts, and operating ham stations. Talk-in on .52/.52, .37/.97 VE3KSR, and .96/.36 VE3ZMG.

MEADVILLE PA
JUN 9

The Crawford Amateur Radio Society will hold its fifth annual hamfest on Saturday, June 9, 1979, at Crawford County Fairgrounds, Meadville, Pennsylvania. Admission is $2.00. Gates will open at 8:00 am. Bring your own tables. The cost to display is $2.00 for an inside area and $1.00 for an outside area. There will be door prizes, refreshments, and commercial displays. Talk-in on .04/.64, .81/.21, .63/.03. For details, write CARS, Hamfest Committee, PO Box 653, Meadville PA 16335.

SENATOBIA MS
JUN 9-10

The fourth annual Tri-State Hamfest will be held on June 9-10, 1979, in the coliseum of Northwest Junior College, Senatobia, Mississippi. Indoor air-conditioned space will be available for manufacturers, dealers, and distributors. For information, contact Joel P. Walker, 1979 Hamfest Chairman, PO Box 276, Hernando MS 38632; (601)-368-5277.

LOUISVILLE KY
JUN 29-JUL 1

The Louisville Area Computer Club will hold its 4th annual Computerfest™ 1979 from June 29 through July 1, 1979, at the Bluegrass Convention Center, Louisville, Kentucky. Activities include a flea market, seminars, and exposition, as well as activities for the entire family. Seminar and exposition admission is $4.00. Pre-registered Ramada Inn guests ($29.00, single; $34.00, double) receive free admission. For advance mail information, write Computerfest '79, Louisville Area Computer Club, PO Box 70355, Louisville KY 40270, or phone Tom Eubank, Chairman, at (502)-895-1230.

BELLEFONTAINE OH
JUL 1

The Champaign Logan Amateur Radio Club, Inc., will hold its annual hamfest on Sunday, July 1, 1979, at the Logan County Fairgrounds, South Main Street and Lake Avenue, Bellefontaine, Ohio. There will be free admission and door prizes. Trunk and table sales are $1.00, and there will also be a bid table. Talk-in on 146.52. For more information, contact John L. Wentz W8HFK, Box 102, West Liberty OH 43357, or Frank Knull W8JS, 402 Lafayette Ave., Urbana OH 43078.

PITTSFIELD MA
JUL 21-22

The NoBARC Hamfest will be held on July 21-22, 1979, at Cummington Fairgrounds, Pittsfield, Massachusetts. There will be tech talks, demonstrations, and dealers. Flea market admission is $1.00. Advance registration is $3.00 single and $5.00 with spouse, and $4.00/$6.00 at the gate. Gates open at 5:00 pm on Friday for free camping. Talk-in on 146.31/.91. For reservations, contact Tom Hamilton WA1VPX, 206 California Ave., Pittsfield MA 01201.

MOOSE JAW
SASKATCHEWAN CAN
JUL 27-29

The Moose Jaw Amateur Radio Club will hold its 1979 Hamfest (Particifest 79) on July 27-29, 1979, at the Saskatchewan Technical Institute, 600 600 Saskatchewan St. W., Moose Jaw, Saskatchewan, Canada. Registration will be held on Firday evening with a full day of activities on Saturday culminating in a banquet and dance. Most of the meetings and workshops will be held on Sunday. There will also be a busy schedule for the XYLs.

FINDLAY OH
SEP 9

The Findlay Radio Club will hold its 37th annual Findlay Hamfest on Sunday, September 9, 1979, at Riverside Park, Findlay, Ohio. There will be both commercial and amateur display space available. Ticket donation is $1.50 in advance and $2.00 at the hamfest site. For more information, write the Findlay Radio Club, c/o Randy Peterson, Hamfest Chairman, 6016 Marion Twp. 243, Findlay OH 45840.

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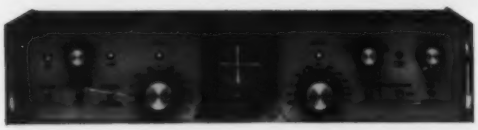

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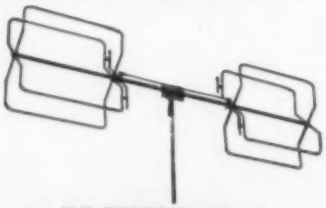

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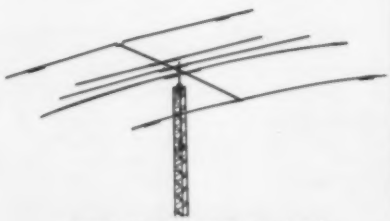

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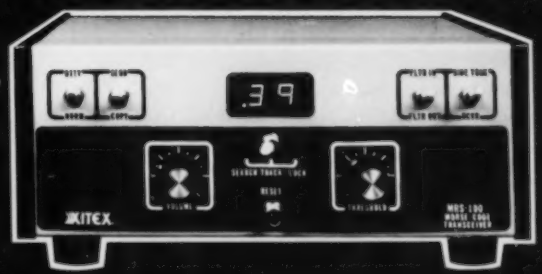

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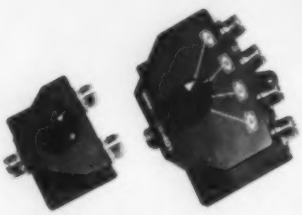

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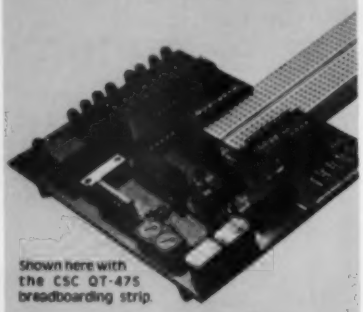

Shown here with the CSC QT-475 breadboarding strip.

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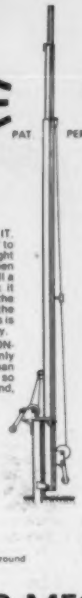

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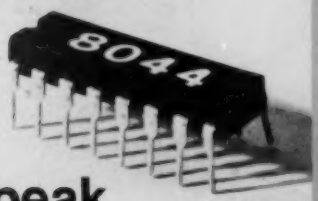

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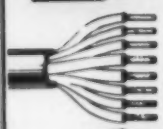
	100	1.8	5.9
39¢/ft	200	2.6	8.5
	300	3.3	10.8
	400	3.8	12.5

8214	50	1.2	3.9
	100	1.8	5.9
25¢/ft.	200	2.6	8.5
	300	3.3	10.8
	400	3.8	12.5

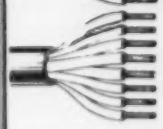
8237	100	2.0	6.6
	200	3.0	9.8
21¢/ft	400	4.7	15.4
	900	7.8	25.6

8267	100	2.0	6.6
	200	3.0	9.8
25¢/ft	400	4.7	15.4
	900	7.8	25.6



8448
16¢/ft

No. of Cond. — 8
AWG (in mm) — 6-22, (7x30), [.76];
2-18, (16x30), [1.19]



9405
26¢/ft

No. of Cond. — 8
AWG (in mm) — 2-16, (26x30), [1.52];
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TR7400A "KENWOOD" OWNERS: SCANNER KIT

- Installs completely inside rig. No obtrusive external connections.
- Scans the complete band or only the portion you select on the MHz switch of your rig (e.g., 144-148 or 146-148 MHz).
- Scan frequency is displayed on digital readout.
- Two miniature toggle switches supplied with kit (scanner: on-off, scan-lock may be mounted externally or on the top or bottom cover of the rig.
- In the scanner off mode the TR-7400A behaves normally. In the scanner ON mode the scanner locks up on an occupied frequency, pauses for a preset time (3-30 seconds) and then resumes scanning. This means you can eavesdrop all over the band without lifting a finger. When you hear something interesting you flip the switch to the lock mode and the rig is ready to transmit.
- Scans at the rate of 50 kHz per second.
- Complete with detailed instructions (even for the beginner).

INTRODUCTORY OFFER
Kit: $39.95 Preassembled: $59.95 (add $1.50 postage & handling)

FT-227 "MEMORIZER" OWNERS: SCANNER KIT

- Selectable sweep width (up to full band).
- Scans *only* the portion of band you select.
- Scans at the rate of 200 kHz per second.
- Switch modification on mike allows you to scan past, or lock on, any occupied frequency.
- Complete kit with detailed instructions.
- Installs *inside* rig: no obtrusive external connections.
- Rig can easily be returned to original condition whenever desired.
- Scans to preset limits and reverses.
- Automatic bypass of locked frequency in 3½ seconds unless you press lock-on switch.
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IC22S OWNERS: SCANNER KIT

- Continuously scans 2m band from 145.35-147.975 in 15 kHz steps.
- LED indicator tells when rig is scanning.
- Switch modification on mike allows you to scan past or lock on to any occupied frequency.
- Memory circuit allows scanner to hold last frequency locked in for at least 2 hours after power is turned off.
- Uses one matrix position leaving the other 21 usable for manual programming.
- Complete kit with detailed instructions, installs inside rig, no obtrusive external connections, no drilling, rig could be returned to original condition if desired.

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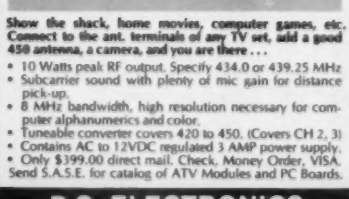

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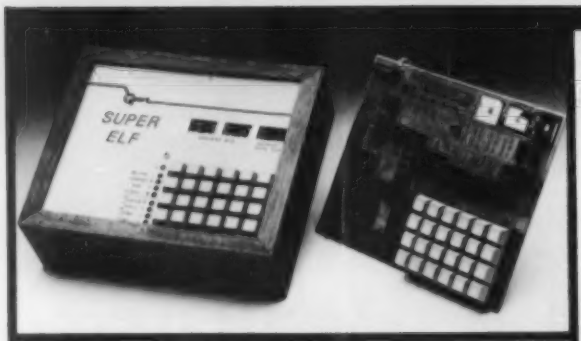

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The **Super Elf** includes a **ROM** monitor for program loading, editing and execution with **SINGLE STEP for program debugging** which is not included in others at the same price. With **SINGLE STEP** you can see the microprocessor chip operating with the **unique Quest** address and data bus displays **before, during** and **after** executing instructions. Also, CPU mode and instruction cycle are decoded and displayed on nine LED indicator lamps.

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A 24 key **HEX keyboard** includes 16 HEX keys plus **load, reset, run, wait, input, memory protect, monitor select** and **single step**. Large, on board displays provide output and optional **high and low address**. There is a 44 pin standard connector for PC cards and a 50 pin connector for the **Quest Super Expansion Board**. Power supply and sockets for **all** IC's are included in the price plus a detailed 90 page instruction manual.

Many schools and universities are using the Super Elf as a course of study. OEM's use it for training and research and development.

Remember, other computers only offer Super Elf features at additional cost or not at all. **Compare before you buy. Super Elf Kit $106.95. High address option $8.95. Low address option $9.95. Custom Cabinet** with drilled and labelled plexiglass front panel **$24.95. NiCad Battery Memory Saver Kit $6.95.** All kits and options also come completely assembled and tested.

Questdata, a 12 page monthly software publication for 1802 computer users is available by subscription for $12.00 per year.

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A 1K Super ROM Monitor $19.95 is available as an on board option in 2708 EPROM which has been preprogrammed with a program loader/editor and error checking multi file cassette read/write software. (relocatible cassette file) another exclusive from Quest. It includes register save and readout, block move capability and video graphics driver with blinking cursor. Break points can be used with the register save feature to isolate program bugs quickly, then follow with single step. The Super Monitor is written with subroutines allowing users to take advantage of monitor functions simply by calling them up. Improvements and revisions are easily done with the monitor. If you have the **Super Expansion Board** and **Super Monitor** the monitor is up and running at the push of a button.

Other on board options include **Parallel Input and Output Ports** with **full handshake**. They allow easy connection of an ASCII keyboard to the input port. **RS 232 and 20 ma Current Loop** for teletype or other device are on board and if you need more memory there are two **S-100** slots for static RAM or video boards. A Godbout 8K RAM board is available for $135.00. Also a 1K Super Monitor version 2 with video driver for full capability display with Tiny Basic and a video interface board. **Parallel I/O Ports $9.85, RS 232 $4.50, TTY 20 ma I/F $1.95, S-100 $4.50. A 50 pin connector set** with ribbon cable is available at $12.50 for easy connection between the **Super Elf** and the **Super Expansion Board.**

The **Power Supply Kit** for the Super Expansion Board is a 5 amp supply with multiple positive and negative voltages $29.95. Add $4.00 for shipping. Prepunched frame $5.00. Case $10.00. Add $1.50 for shipping.

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7432N	39	LM733N	60	74C14	2.10	IC SOCKETS		10 per type .03 1000 per type .017	
7440N	20	LM741CH	35	74C20	.29	Solder Tin Low Profile		25 per type .025 250 piece pack	
7442N	50	LM741N	25	74C30	.29	Pin 1 UP Pin UP		100 per type .015 5 per type 6.75	
7447N	69	LM747HN	60	74C48	1.95	8 .15 .22 .28			
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7450N	17	LM1310N	60	74C76	1.40	16 .20 .26 .42		56 key ASCII keyboard kit	$67.50
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7460N	17	LM2111	1.75	74C90	.75	14 pin .25			
7470N	29	MC3302	1.50	74C914	1.95	16 pin .30		EXAR	
7472N	24	LM3900N	.60	74C923	5.50	18 pin .35		Rad 1010	19
7473N	39	LM3905	1.75	74C925	6.95	22 pin .40		Green, Yellow 1010	39
7474N	29	LM3909N	.60	74C926	6.95	24 pin .45		Jumbo Red	29
7475N	69	MC1458V	.50	74C927	6.95	28 pin .50		Green, Orange, Yellow Jumbo	39
7480N	35	NE540L	2.00			40 pin .60		Digalite LED Mounting Clips 5/$1.25	
7483N	69	NE550N	65			WIRE WRAP LEVEL 3		Specify red, amber, green, yellow (Mark)	
7485N	1.00	NE555V	43	INTERFACE		PIN PIN			
7486N	29	NE556A	79	8095	65	8 .15 .22 .28		ENVIRONMENTAL SPECIALTIES or when	
7489N	87	NE565A	1.00	8097	65	14 .23 .24 .86		Complete line of broadband test equip.	
7490N	50	NE566V	1.50	8098	65	16 .33 .28 1.00		MAX-100 8 digit Freq. Ctr. $129.95	
7491N	67	NE567V	1.20	8212	1.75	18 .37 .40 1.23		100 MHz MAX-100/LS in stock	
7492N	50	NE5708	5.00	8216	4.50			Portable Multimeter	$19.00
7493N	50	NE5710	5.50	8224	3.00	UART/FIFO		DIGITAL THERMOMETER	$49.95
7495N	1.15	TBL05	.65	8228	3.00	AY5-1013	5.50	Batt. oper. General purpose or medical	
7496N	87	TBL06	.60	8253	5.50	AY5-1014	7.50	32°-230°F. Disposable probe cover	
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152	1.43	194	.82	279	5.85	317	24.20
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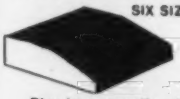

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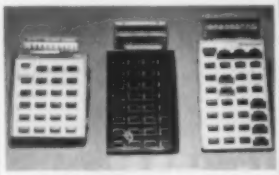

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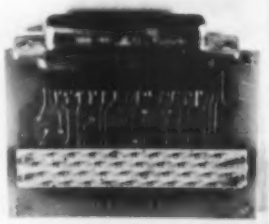

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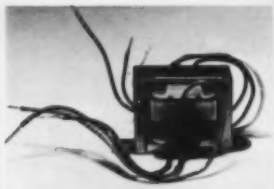

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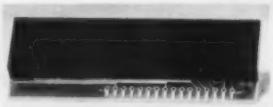

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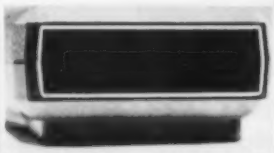

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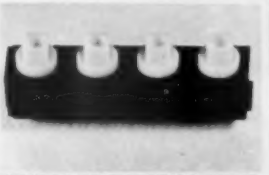

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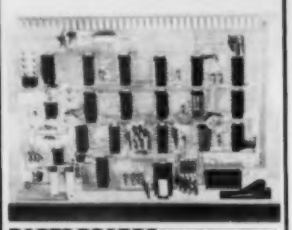

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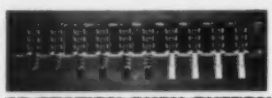

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BULLET ELECTRONICS

»NEW ADDRESS & PHONE NO.
PO BOX 401244E (214) 278-3553
GARLAND TEXAS 75040

sale

Harris HA2825 Phase Lock Loop 14 pin dip	.80
LM340-12 12V 1A Regulator Hse. # TO-3	1.10
SAJ110 Seven Stage Frequency Divider w/specs	3/1.00
5082 Mostek 6 Digit Chip w/specs 28 pin dip	1.90
MAN84 Common Anode Readout Large Character	6/4.00
FND358 Common Cathode Readout .4" Character	9/3.75
FND70 Common Cathode Readout .3" Character	.60
FND71 Common Cathode ±1 Character Matches FND70	.65
TIP-30 PNP 30W Vceo—40V IC—1A Tab mount TO-220	3/1.00
ZN4400 NPN Gen. Purpose Similar to 2N3904	8/1.00
ZN4402 PNP Compliment to ZN4400	8/1.00

UNIVERSAL SOUND EFFECTS BOARD

HAVE YOU EVER WISHED YOU COULD DUPLICATE THE SOUND OF A STEAM TRAIN OR A PHASOR GUN? HOW ABOUT GUNSHOTS, WHISTLES, SIRENS, BARKING DOGS AND OTHER SOUND EFFECTS? NOW YOU CAN WITH OUR PROGRAMMABLE SOUND EFFECTS KIT. IT USES THE NEW 28 PIN T.I. SOUND SYNTHESYZER CHIP, SN76477 AND SUPPORT CIRCUITRY. 5 TO 12VDC IS REQUIRED TO GIVE APPROX. 1/4 WATT OF AUDIO OUTPUT. WE PROVIDE THE P.C. BOARD, PARTS AND INSTRUCTIONS ALONG WITH A CHART TO PROGRAM SOME COMMON SOUNDS. USE YOUR IMAGINATION TO CREATE ORIGINAL SOUND EFFECTS. ORDER: SE-01 **16.95**(Less Spkr.) 3/39.95

YOU'VE SEEN IT ON QUALITY STEREO GEAR

SUPER DEAL!

BLACK INSERT

BRUSHED CHROME

7/8" hole to hole

DPDT Toggle ALCO CBT-202 .3A @ 125V

.49

MC1469R POSITIVE VOLTAGE REGULATOR

1 AMP COMPLETE SPECS AND APPLICATIONS SHOW HOW TO BUILD FIXED OR VARIABLE POWER SUPPLIES FROM 5 TO 30VDC. DRIVE EXTERNAL SERIES PASS FOR CURRENT TO 20 AMPS!

1.25 EA.
10/10.00

25A 100V SCR 1.95

Perfect for battery chargers, switching supplies, crowbars, etc.

739 FAIRCHILD

DUAL LOW NOISE AUDIO PRE-AMPLIFIER

89¢ 2/1.69

2N5484 N Channel J-FET VHF/UHF Amp to 400MHZ. TO-92 .50

MPF131 N-CHANNEL DUAL GATE MOSFET 50¢

DESIGNED FOR AMPLIFIER AND MIXER APPLICATIONS TO 200 MHZ. PLASTIC CASE. UNITS ARE HOUSE NUMBERED WITH SPECS.

MJ900 - MJ1000

COMPLIMENTARY PNP NPN DARLINGTON POWER TRANSISTORS. 8 AMPS. WE SUPPLY A SCHEMATIC TO BUILD A HIGH POWER (80W) LOW DISTORTION AUDIO AMP WITH ONLY ONE ADDITIONAL TRANSISTOR AND A DOZEN INEXPENSIVE COMPONENTS! TO-3 CASE STYLE. BUY A PAIR FOR

$3.00!

FANTASTIC SOUND EFFECTS CHIP

THIS 28 PIN MARVEL CONTAINS A LOW FREQUENCY OSCILLATOR VCO, NOISE OSCILLATOR, ONE SHOT, MIXER AND ENVELOPE CONTROL WITH 8 PAGE MANUAL. 5 to 9VDC 3.95

EMITTER RESISTORS

HARD TO FIND VALUES!

1 ohm @ 5W

7/1.00

LM3900 QUAD NORTON AMP

WE BOUGHT A LARGE QUANTITY OF THESE HOUSE NUMBERED PARTS AT A BARGAIN PRICE THAT ALLOWS US TO SELL THEM AT A LOW LOW .29¢

IL-1 OPTO ISOLATORS

BY LITRONIX 6 PIN DIP STANDARD PINOUT LED-TRANSISTOR COMBINATION

50¢
WHILE THEY LAST!

WIREWRAP Wire

30 Gauge KYNAR® Insulat.

500 FT

4.50

6 DIGIT ZULU CLOCK KIT

At last a clock for HAMS. Designed with large bright LED digits to enhance your shack. The unit is a pleasure to assemble and so easy on the budget! You get top quality parts and plated PC Boards. The unique design of the board set eliminates the headaches of running wires between clock and readout board. As a bonus the unit has a switchable timer that can be reset to zero without disturbing real time. Elapsed time in minutes and seconds up to 25 minutes. Six full sized FND510 readouts and colons making viewing easy from across the room. Does NOT use the old style 5314 chip. **DUE TO A SPECIAL PURCHASE WE HAVE A LIMITED QUANTITY.**

We Promised!

COMPLETE ZULU CLOCK KIT

Includes: All components, plated, drilled PC Boards, large easy to read instructions, and AC transformer. Clock board: 2¾" X 4¼". Readout Board: 1½" X 4½".

10.00
24 Hr. Format Only

Hand made solid hardwood case for the Zulu Clock. Includes ruby front filter and back panel.

6.95

ALL COMPONENTS 100% GUARANTEED

CA3011 WIDEBAND IF AMP w/specs	50¢
2N3906 NPN EPOXY 1W	6/1.00
741 OP AMP 8 PIN DIP	5/1.00
723 VOLTAGE REG. 14 PIN DIP	50¢
MPS6530 NPN HOUSE #	8/1.00
725 OP AMP LOW NOISE HOUSE #	99¢
7815 15V 1A REGULATOR HOUSE #	69¢
2N4393 P CHANNEL J FET	4/1.00
2N6111 PNP MED PWR 40W TO-220	3/1.00
2N6027 PROGRAMMABLE UNIJUNC.	50¢
TICN w/specs	
TRIAC 200V 6A UNMARKED	3/1.00

Diodes

1N4003	200V 1A	15/1.00
1N4005	600V 1A	12/1.00
1N270	Germanium Diode	8/1.00
1N38A	Germanium Diode	10/100
1N4148	Cut & Bent for PC Board Insertion	100/1.25

UNMARKED POWER DIODES with cathode bands. Guaranteed to be at least 400PIV @ 1A. 100% Good parts. Epoxy case.

29/1.00

WARBLE ALARM KIT

A fun EASY kit to assemble that emits an ear piercing 10 watt dual tone scream. Resembles European siren sound. Great for alarms or toys. Operates from 5–12VDC at up to 1 amp (using 12VDC×8 ohm speaker). Over five thousand have been sold. All parts including PC board, less speaker. **2.50** ORDER WB-02

POWER SUPPLY KIT PS-14

- Better than 200MV load and line regulation
- Foldback Current Limiting
- Short Circuit Protected
- Thermal Shutdown
- Adjustable Current Limiting
- Less than 1% ripple.
- 15 amps 11.5 to 14.5V
- All parts supplied including heavy duty trans former.
- Quality plated fiberglass PC board.

Less Case, meters & jacks

UPS SHIPPING PAID!

REVIEWED IN 7/78 73 MAG.

15A CONT. 20A INT. 42.95

MV1624 Varicap Diode 10pfd Nom. 2:1 Tuning Range 49¢

2N5583 High Freq. Amp 1 Watt @ 1.5 GHZ! TO-5 Case style, House # 90¢

MFC4000B ¼ Watt Audio Amp 4 pin plastic pack 50¢

MR1813 100V 3A SCR Ultra sensitive gate drives from TTL. TO-220 59¢

MR256 50V 3A Triac Sensitive Gate TO-5 49¢

FND510 .60¢

COMMON ANODE READOUT CHARACTER
LIMIT 24 PER CUSTOMER!

LED'S

JUMBO RED 5/.80
GREEN 4/.80
MEDIUM RED .15
GREEN .16
YELLOW .16
MINI RED .10

MC1351P FM-IF AMP AND DISCRIMINATOR

USED IN FM & TV SOUND CIRCUITS. REQUIRES MINIMUM EXTERNAL COMPONENTS. 14 PIN DIP. DIRECT REPLACEMENT FOR HEPC 5050, ECG 746 and MANY OTHERS! HOUSE # WITH SPECS 50¢

MC3361P HOUSE #

4 DP AMPS IN ONE PACKAGE. USES SINGLE SUPPLY (4 to 28VDC). INTERNALLY COMPENSATED 5MG.00 TO MC3401. BUT HIGHER GAIN 49¢

OVERVOLTAGE PROTECTION KIT 6.95

Provides cheap insurance for your expensive equipment. Trip voltage is adjustable from 3 to 30 volts. Overvoltage instantly fires a 25A SCR and shorts the output to protect equipment. Should be used on units that are fused. Directly compatible with the PS-12 and PS-14. All electronics supplied. Drilled and plated PC board. (Order OVP-1)

CAPACITORS

SINGLE RATE!

2200 MFD @ 16 VDC RADIAL 3/1.00

330 MFD @ 50V Electrolytic 5/1.00 Radial

220 MFD @ 25VDC 7/1.00 AXIAL

1 MFD @ 200VDC DISC CERAMIC 10/1.00

.022	@ 100VDC Mylar	8/1.00
.22	@ 50VDC Mylar	6/1.00
1.5mfd	@ 400VDC Mylar	4/1.00
22mfd	@ 20V Dip Tant	4/1.00
33mfd	@ 10V Dip Tant	4/1.00

NEVER A SWEETER METER!

Beautiful **American made** panel meters are a snap to install. Huge 3½" wide dials are easy to read. You would expect to pay more for each than we get for the pair! MATCHED SET 0-15VDC, 0-30ADC

12.95 *Set*

MK-03A CLOCK/TIMER KIT

Features 24 hour Zulu time and up to 24 hours of elapsed time on the same set of six digit LED readouts. Totally independent operation of both functions. Clock has presettable alarm with 10 minute snooze. Timer has reset, hold, and count functions. Full noise and overvoltage protection. 24 hour only. Readouts has dimmer feature or they can be turned off without disturbing the clock or timer. Timebase included (.01% accuracy). Because of the many options and mounting considerations the case and switches are not included. Switches are standard types. Will fit inside standard aircraft instrument case.

9–14VDC 28.95

New Items

72301	General Purpose Op Amp 8 Lead Can	3/1.00
72723	Volt. Reg. IC (Texas Instruments) 10 Lead Can	.89
13741	FET Input 741 Op Amp Hse. # Mini Dip	3/1.10
6-36 PFD	Ceramic Trimmer Cap Small & Stable	.45 10/3.00
30,000 MFD	15 Volts Computer Grade Cap 3½" height	2.10 10/18.00
3.3mfd	6.3VDC Dip Tantalum (import) Radial Leads	12/1.00

See You in DAYTON !

ZENER GRAB BAG

A very nice assortment of ¼, ½ & 1W zeners. Voltage ranges are from 2.7 to 30 VDC. Most have house # but we provide a cross over list to standard numbers. A great buy for any shop. 12 different types.

50¢

- NO COD'S
- SEND CHECK OR MONEY ORDER OR CHARGE CARD NO.
- ADD 5% FOR SHIPPING
- TEX RESIDENTS ADD 5% TAX
- FOREIGN ORDERS ADD 10%,
- ORDERS UNDER $10. ADD .75 for HANDLING

PHONE ORDERS ACCEPTED ON VISA & MC

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FREQUENCY COUNTER KIT

Outstanding Performance

Incredible Price $89.95

CT-50

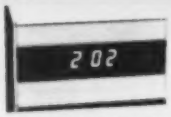
The CT-50 is a versatile and precision frequency counter which will measure frequencies to 60 mHz and up to 600 mHz with the CT-600 option. Large Scale Integration CMOS circuitry and solid state display technology have enabled this counter to match performance found in units selling for over three times as much. Low power consumption (typically 300-400 mA) makes the CT-50 ideal for portable battery operation. Features of the CT-50 include: large 8 digit LED display, RF shielded all metal case, easy push-button operation, automatic decimal point, fully socketed IC chips and input protection to 50 volts to insure against accidental burnout or overload. And, the best feature of all is the easy assembly. Clear, step by step instructions guide you to a finished unit you can rely on.

Order your today!

SPECIFICATIONS:
Frequency range: 6 Hz to 65 mHz, 600 mHz with CT-600
Resolution: 10 Hz/∞, 0.1 sec gate, 1 Hz/∞, 1 sec gate
Readout: 8 digit, 0.4" high LED, direct readout in mHz
Accuracy: adjustable to 0.5 ppm
Stability: 2.0 ppm over 10° to 40° C temperature compensated
Input: BNC, 1 megohm/ 20 pf direct, 50 ohm with CT-600
Overload: 50VAC maximum, all modes
Sensitivity: less than 25 mv to 65 mHz, 50-150 mv to 600 mHz
Power: 110 VAC, 5 Watts or 12 VDC, 400 ma
Size: 6" x 4" x 2", high quality aluminum case, 2 lbs
IC'S: 13 units, all socketed

CT-50, 60 mHz counter kit	$89.95
CT-50WT, 60 mHz counter, wired and tested	159.95
CT-600, 600 mHz scaler option, add	29.95
CB-1, Color TV calibrator/stabilizer	$14.95
DP-1, DC probe, general purpose probe	12.95
HP-1, high impedance probe, non loading	15.95

CAR CLOCK



The UN-KIT, only 5 solder connections

Here's a super looking, rugged and accurate auto clock, which is a snap to build and install. Clock movement is completely assembled—you only solder 3 wires and 2 switches, takes about 15 minutes! Display is bright green with automatic brightness control photocell—assures you of a highly readable display, day or night. Comes in a satin finish anodized aluminum case which can be attached 5 different ways using 2 sided tape. Choice of silver, black or gold case (specify).

DC-3 kit, 12 hour format	$22.95
DC-3 wired and tested	$29.95
110V AC adapter	$5.95

Under dash car clock

12/24 hour clock in a beautiful plastic case features 6 jumbo RED LEDS, high accuracy (1min/mo.), easy 3 wire hookup, display blanks with ignition, and super instructions. Optional dimmer automatically adjusts display to ambient light level.

DC-11 clock with mtg. bracket	$27.95
DM-1 dimmer adapter	2.50

PRESCALER

Extend the range of your counter to 600 mHz. Works with any counter. Includes 2 transistor pre-amp to give super sens, typically 20 mv at 150 mHz. Specify ÷ 10 or ÷ 100 ratio.

PS-1B, 600 mHz prescaler	$59.95
PS-1BK, 600 mHz prescaler kit	49.95

OP-AMP SPECIAL

741 mini dip	12/$2.00
B1-FET mini dip, 741 type	10/$2.00

VIDEO TERMINAL

A completely self-contained, stand alone video terminal card. Requires only an ASCII keyboard and TV set to become a complete terminal unit. Two units available, common features are: single 5V supply, XTAL controlled sync and baud rates (to 9600), complete computer and keyboard control of cursor. Parity error control and display. Accepts and generates serial ASCII plus parallel keyboard input. The 3216 is 32 char. by 16 lines, 2 pages with memory dump feature. The 6416 is 64 char. by 16 lines, with scrolling, upper and lower case (optional) and has RS-232 and 20ma loop interfaces on board. Kits include sockets and complete documentation.

RE 3216, terminal card	$149.95
RE 6416, terminal card	189.95
Lower Case option, 6416 only	13.95
Power Supply Kit	14.95
Video/RF Modulator, VD-1	6.95
Assembled, tested units, add	60.00

CALENDAR ALARM CLOCK

The clock that's got it all: 6- 5" LEDs, 12/24 hour, snooze, 24 hour alarm, 4 year calendar, battery backup, and lots more. The super 7001 chip is used. Size: 5x4x2 inches.

Complete kit, less case (not available)

DC-9	$34.95

30 Watt 2 mtr PWR AMP

Simple Class C power amp features 8 times power gain. 1 W in for 8 out, 2 in for 15 out, 4 W in for 30 out. Max. output of 35 W, incredible value, complete with all parts, less case and T-R relay.

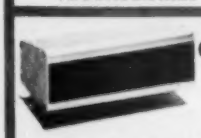
PA-1, 30 W pwr amp kit	$22.95
TR-1, RF sensed T-R relay kit	6.95

FM MINI MIKE KIT

A super high performance FM wireless mike kit! Transmits a stable signal up to 300 yards with exceptional audio quality by means of its built in electret mike. Kit includes case, mike, on-off switch, antenna, battery and super instructions. This is the finest unit available.

FM-3 kit	$12.95
FM-3 wired and tested	16.95

CLOCK KITS



our Best Seller your Best Deal

Try your hand at building the finest looking clock on the market. Its satin finish anodized aluminum case looks great anywhere, while six .4" LED digits provide a highly readable display. This is a complete kit, no extras needed, and it only takes 1-2 hours to assemble. Your choice of case colors: silver, gold, bronze, black, blue (specify).

Clock kit, 12/24 hour, DC-5	$22.95
Clock with 10 min. ID timer, 12/24 hour, DC-10	27.95
Alarm clock, 12 hour only, DC-8	24.95
12V DC car clock, DC-7	27.95

For wired and tested clocks add $10.00 to kit price.

Hard to find PARTS

LINEAR ICs		**REGULATORS**	
301	$ .35	78MG	$1.25
324	1.50	723	.50
380	1.25	309K	.85
380-8	.75	7805	.85
555	.45	78L05	.25
556	.85	7905	1.25
566	1.15	7812	.85
567	1.25	7912	1.25
1458	.50	7815	.85
3900	.50	**TTL ICs**	
CMOS ICs		74S00	.35
4011	.20	7447	.65
4013	.35	7475	.50
4046	1.85	7490	.50
4049	.40	74196TI	1.35
4518	1.25	**SPECIAL ICs**	
5369	1.75	11C90	13.50
TRANSISTORS		10116	1.25
2N3904 type	10/1.00	4511	2.00
2N3906 type	10/1.00	5314	2.95
NPN 30W Pwr	3/1.00	5375AB	2.95
PNP 30W Pwr	3/1.00	7001	6.50
2N3055	.60	4059 ÷ N	9.00
UJT 2N2646 type	3/2.00	7208	17.95
FET MPF102 type	3/2.00	**LEDs**	
UHF 2N5179 type	3/2.00	Jumbo red	8/1.00
MRF-238 RF	11.95	Jumbo green	6/1.00
SOCKETS		Jumbo yellow	6/1.00
8 pin	10/2.00	Mini red	8/1.00
14 pin	10/2.00	Micro red	8/1.00
16 pin	10/2.00	Bi-Polar	.75
24 pin	4/2.00	**FERRITE BEADS**	
28 pin	4/2.00	With info. specs	.15/1.00
40 pin	3/2.00	6 hole balun	.5/1.00

Ramsey's famous MINI-KITS

FM WIRELESS MIKE KIT

Transmits up to 300' to any FM broadcast radio, uses any type of mike. Runs on 3 to 9V. Type FM-2 has added sensitive mike preamp stage.

FM-1 kit $2.95 FM-2 kit $4.95

COLOR ORGAN/MUSIC LIGHTS

See music come alive! 3 different lights flicker with music. One light for lows, one for the mid-range and one for the highs. Each channel individually adjustable, and drives up to 300W. Great for parties, band music, nite clubs and more.

Complete kit, ML-1 $7.95

LED BLINKY KIT

A great attention getter which alternately flashes 2 jumbo LEDs. Use for name badges, buttons, warning panel lights, anything! Runs on 3 to 15 volts.

Complete kit, BL-1 $2.95

VIDEO MODULATOR KIT

Converts any TV to video monitor. Super stable, tunable over ch. 4-6. Runs on 5-15V, accepts std. video signal. Best unit on the market!

Complete kit, VD-1 $6.95

TONE DECODER

A complete tone decoder on a single PC board. Features 400-5000 Hz adjustable range via 20 turn pot, voltage regulation, 567 IC. Useful for touch-tone decoding, tone burst detection, FSK, etc. Can also be used as a stable tone encoder. Runs on 5 to 12 volts.

Complete kit, TD-1 $5.95

WHISPER LIGHT KIT

An interesting kit, small mike picks up sounds and converts them to light. The louder the sound, the brighter the light. Completely self-contained, includes mike, runs on 110VAC, controls up to 300 watts.

Complete kit, WL-1 $6.95

SUPER SLEUTH

A super sensitive amplifier which will pick up a pin drop at 15 feet! Great for monitoring baby's room or as general purpose amplifier. Full 2 W rms output, runs on 6 to 15 volts, uses 8-45 ohm speaker.

Complete kit, BN-9 $5.95

POWER SUPPLY KIT

Complete triple regulated power supply provides variable ÷ 6 to 18 volts at 200 ma and + 5V at 1 Amp. Excellent load regulation, good filtering and small size. Less transformers, requires 6.3V @ 1 A and 24 VCT.

Complete kit, PS-3LT $8.95

SIREN KIT

Produces upward and downward wail characteristic of a police siren. 5 W peak audio output, runs on 3-15 volts, uses 3-45 ohm speaker.

Complete kit, SM-3 $2.95

ramsey electronics

BOX 4072, ROCHESTER, N.Y. 14610

PHONE ORDERS CALL (716) 271-6487

TERMS: Satisfaction guaranteed or money refunded. COD, add $1.50. Minimum order $6.00. Orders under $10.00, add $.75. Add 5% for postage, insurance, handling. Overseas, add 15%. NY residents, add 7% tax.

RB

hamtronics, inc.

H16 **OSCAR HEADQUARTERS**

★ **Quality VHF & UHF Kits At Affordable Prices**

SSB TRANSMITTING CONVERTERS

FEATURES:

- Linear Converter for SSB, CW, FM, etc.
- A fraction of the price of other units
- 2W p.e.p. output with 1 MW of drive
- Use low power tap on exciter or attenuator pad
- Easy to align with built-in test points

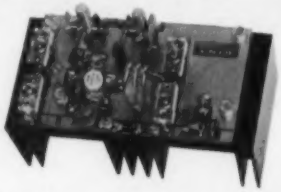
Frequency Schemes Available:

MODEL	INPUT(MHz)	OUTPUT(MHz)
XV2-1	28-30	50-52
XV2-2	28-30	220-222
XV2-3	28-30	222-224
XV2-4	28-30	144-146
XV2-5	28-29	145-146
XV2-6	26-28	144-146

ONLY $59.95!

VHF Linear PA's

- Use as Linear or Class C PA's
- For XV-2 Xmtg Converters, T50 Exciters, or any 2W Exciter



LPA 2-15 Kit $59.95

- 15W out (linear) or 20W (class C)
- Solid State T/R Switching
- Models for 6M, 2M, or 220 MHz

LPA 2-45 Kit $109.95

- 45W out (linear) or 50W (class C)
- Models for 6M or 2M

LPA 8-45 Kit $89.95

For 2M, 8-10W in, 45W out

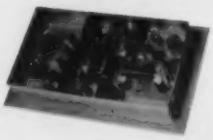
T80 UHF POWER AMP

- Broadband PA
- No Tuning Required
- Class C PA
- 430-470 MHz
- 13-15W Out
- 200 mW Drive

Model T80-450
$79.95
Wired & Tested

VHF RECEIVING CONVERTERS

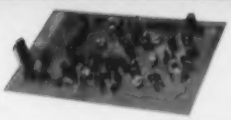
LET YOU RECEIVE OSCAR AND OTHER EXCITING SIGNALS ON YOUR PRESENT HF RECEIVER!



MODEL	RF RANGE	I-F RANGE
C28	28-32MHz	144-148MHz
C50	50-52	28-30
C144	144-146	28-30
C145	145-147	28-30
C146	146-148	28-30
C110	Aircraft	26-30
C220	220-222	28-30
C222	222-224	28-30
Special	Inquire About Other Ranges	

ONLY $34.95

UHF RECEIVING CONVERTERS



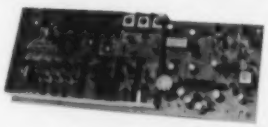
MODEL	RF RANGE	I-F RANGE
C432-2	432-434	28-30MHz
C432-4	432-436	144-146
C432-5	435-437	28-30
C432-7	427.25	61.25
C432-9	439.25	61.25
Special	Inquire About Other Ranges	

ONLY $34.95

A9 Extruded Alum Case with BNC's for above Converters (Optional) ... $12.95

VHF& UHF FM RECEIVERS

- NEW GENERATION RECEIVERS
- MORE SENSITIVE
- MORE SELECTIVE (70 or 100 dB)
- COMMERCIAL GRADE DESIGN
- EASY TO ALIGN WITH BUILT-IN TEST CKTS
- LOWER OVERALL COST THAN EVER BEFORE



R70 6-channel VHF Receiver Kit for 2M, 6M, 10M, 220 MHz, or com'l bands..... $69.95
Optional xtal filter for 100 dB adj chan 10.00

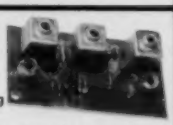
R90 UHF Receiver Kit for any 2 MHz segment of 380-520 MHz band..... $89.95

FAMOUS HAMTRONICS PREAMPS

let you hear the weak ones!

Great for OSCAR, SSB, FM, ATV. Over 10,000 in use throughout the world on all types of receivers.

P9 Kit $12.95
P14 Wired $24.95
Specify Band When Ordering

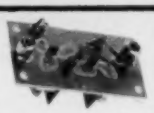


- Deluxe vhf model for applications where space permits
- 1-1/2 x 3"
- Models avail to cover any 4 MHz band in the 26-230 MHz range
- 12 Vdc
- 2 stages
- Ideal for OSCAR
- 20 db gain
- Diode transient protection
- Easily tunable

P8 Kit $10.95
P16 Wired $21.95
Specify Band

- Miniature vhf model for tight spaces - size only 1/2x2-3/8
- Models avail to cover any 4 MHz band in the range 20-230 MHz
- 20 db gain
- 12V

P15 Kit $18.95
P35 Wired $34.95



- Covers any 6 MHz band in UHF range of 380-520 MHz
- 20 dB gain
- 2 stages
- Low noise

NEW FM/CW EXCITER KITS

BUILD UP YOUR OWN GEAR FOR MODULAR STATIONS, REPEATERS, & CONTROL LINKS

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T50 Six Channel, 2W Exciter for 2M, 6M, or 220 MHz (Specify band)..... $49.95

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--Dealer Inquiries Invited--

Reader Service—see page 195

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- ★**Weston Meter - 4½x5½.** Mirrored Scale. 0-120Scale. 1MA. **$3.17 ea.**
- ★**Mallory Computer Grade.** 48,000 MFD 25WVDC. 40V Surge. **$2.92 ea.**
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- ★**Power Relay.** 24VAC Coil. 3PDT. 10 AMP Contacts. $1.35 ea. **10/$11.00**
- ★**Audio Output XFMR Miniature.** 1000 OHM to 8 OHM. 46¢ ea.**10/$3.80**
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- ★**Allen Bradley Res.** 1K OHM 2W.5% **20 for 94¢**
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- ★**IC Project Board.** 3/4x2½ in. Holds 2 DIP's. **5 for 90¢**
- ★**Mostek Calculator Chips.** MK50282. Five Functions with Sheet. 46¢ ea. **10/$3.80**
- ★**Ceramic Trim Caps.** Arco PC402. 2 to 20 PF. **4 for 53¢**
- ★**Mylar Cap.** .12 MFD 100 V. 5% Axial. **15 for $1.06**
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- ★**Tantalum Cap.** Mallory. .56 MFD 35V Axial. **12 for 47¢**
- ★**TRW Resistor.** 820 OHMS. 1W. 5% **50 for $1.85**
- ★**TO-220 Heatsink.** By IERC. Black PC Mount. **20 for $2.90**
- ★**Motorola Audio AMP IC.** 2 Watt. MC1316P with Sheet. 65¢ ea. **10/$5.30**
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- ★**1N4003 Rectifiers.** 1 AMP 200 PIV. PC Leads. **100 for $2.40**
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- ★**Mylar Cap.** Green Radial Type. .068 MFD 100V. **10 for 46¢**
- ★**OP AMP.** LM358. Mini Dip. House # 41¢ ea.**10 for $3.65**
- ★**Stud Rectifier.** 35 AMP. 300 PIV. MOT. 1N1187. 73¢ ea. **10/$6.60**
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- ★**Power Resistor.** 6.8K OHMS 4Watts. **10 for 91¢**
- ★**2 Watt Resistor.** 22K OHMS **30 for $1.07**
- ★**74164 TTL.** House # 8 Bit. SIPO Shift Register. 26¢ ea. **10/$2.15**
- ★**TO-3 Heatsink.** For 309K, etc. Thermalloy #6001B-2. **8 for $1.86**
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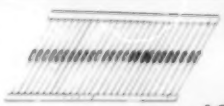
- ★**LM113 Precision Voltage Reference.** To-18 Case. **$1.18 ea.**
- ★**LM301 High Performance OP AMP.** Metal Can. **10 for $2.18**
- ★**Mini Clock Module.** 4 Digits with Timebase. Removed from Eqmt. **$7.85**



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2200 MFD 16WVDC
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$5.99 each

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GE Ni-Cad Battery Pack
3 Cell pack, gives 4 volts at 900MAH. Brand new, factory fresh. Each cell is 2/3 "C" size. **$2.95.**
Buy 3 packs (12 volts) for $6.95. Limited stock!

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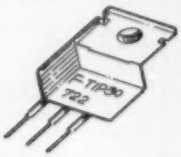
SILICON NPN AND PNP. TO-220 CASE.
VCEO - 40V PD - 30 WATTS
FOR AUDIO POWER AMPS, ETC.



TIP29 - NPN
TIP30 - PNP

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TO-220 CASE

15 AMP 400 PRV

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A full .80 inch character. The biggest readout we have ever sold! Super efficient. Compare at up to $2.95 each from others!

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2N4402. TO-92 Plastic. Silicon PNP Driver. High Current. VCEO-40 HFE-50 to 150 at 150 MA. FT-150 MHZ. A super "BEEFED—UP" Version of the 2N3906.

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#FLV5057. Medium Size. Clear Case. RED EMITTING. These are not retested off-spec units as sold by some of our competition. These are factory prime, first quality, new units.

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We do not know what these boards were used in, but they do contain a wealth of quality components. Board has: 2-12VDC 200 OHM SPDT Mini Relays, 1-CD4001 CMOS, 4-LM358 High Performance OP AMPS (same as 1/2 LM324), 1-MOTOROLA MC3340 Mini Dip, 1-Audio Output Transformer, 1-TIP30 30 WATT PNP Power Transistor, plus 70 more assorted components. All parts easily removed.

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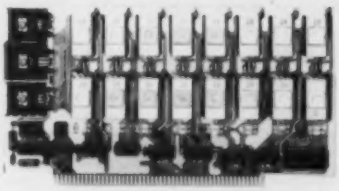
16K EPROM CARD-S 100 BUSS



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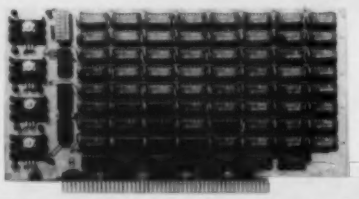
OUR 450NS 2708'S ARE $8.95 EA. WITH PURCHASE OF KIT

ASSEMBLED AND FULLY TESTED ADD $25

8K LOW POWER RAM KIT-S 100 BUSS

250 NS SALE!



ADD $5 FOR 250NS!

$129 KIT

Use 21L02 450 NS RAMS!

Thousands of computer systems rely on this rugged, work horse, RAM board. Designed for error-free, NO HASSLE, systems use.

KIT FEATURES:

1. Doubled sided PC Board with solder mask and silk screen layout.Gold plated contact fingers.
2. All sockets included.
3. Fully buffered on all address and data lines.
4. Phantom is jumper selectable to pin 67.
5. FOUR 7805 regulators are provided on card.

Blank PC Board w/Documentation **$29.95**
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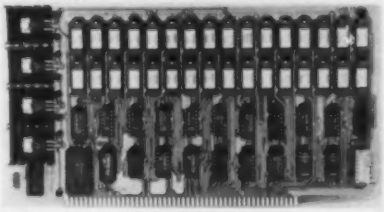
Support IC's (TTL & Regulators) **$9.75**
Bypass CAP's (Disc & Tantalums) **$4.50**

ASSEMBLED AND FULLY BURNED IN ADD $30

16K STATIC RAM KIT-S 100 BUSS

$295 KIT

FULLY STATIC, AT DYNAMIC PRICES



WHY THE 2114 RAM CHIP?

We feel the 2114 will be the next industry standard RAM chip (like the 2102 was). This means price, availability, and quality will all be good! Next, the 2114 is FULLY STATIC! We feel this is the **ONLY** way to go on the S-100 Buss! We've all heard the HORROR stories about some Dynamic Ram Boards having trouble with DMA and FLOPPY DISC DRIVES. Who needs these kinds of problems? And finally, even among other 4K Static RAM's the 2114 stands out! Not all 4K static Rams are created equal! Some of the other 4K's have **clocked** chip enable lines and various timing windows **just as critical** as Dynamic RAM's. Some of our competitor's 16K boards use these "tricky" devices. But not us! The 2114 is the ONLY logical choice for a trouble-free, straightforward design.

KIT FEATURES:

1. Addressable as four separate 4K Blocks.
2. ON BOARD BANK SELECT circuitry. (Cromemco Standard!). Allows up to 512K on line!
3. Uses 2114 (450NS) 4K Static Rams.
4. ON BOARD SELECTABLE WAIT STATES.
5. Double sided PC Board, with solder mask and silk screened layout. Gold plated contact fingers.
6. All address and data lines fully buffered.
7. Kit includes ALL parts and sockets.
8. PHANTOM is jumpered to PIN 67.
9. LOW POWER: under 2 amps TYPICAL from the +8 Volt Buss.
10. Blank PC Board can be populated as any multiple of 4K.

BLANK PC BOARD W/DATA—**$33**
LOW PROFILE SOCKET SET—**$12**
SUPPORT IC'S & CAPS—**$19.95**
ASSEMBLED & TESTED—**ADD $30**
2114 RAM'S—**8 FOR $69.95**

60 Hz CRYSTAL TIME BASE

$4.95 (Complete Kit)

Uses MM5369 CMOS divider IC with high accuracy 3.579545 MHZ Crystal. Use with all MOS Clock Chips or Modules. Draws only 1.5 MA. All parts, data, and PC Board included.

100 HZ CRYSTAL TIME BASE

$5.95 (Complete Kit)

Same as above, except it uses a special MM5369. Perfect for frequency counter time bases, etc. Also use with MOSTEK MK50397 timer chip.

16K DYNAMIC RAM CHIP

16K X 1 Bits. 16 Pin Package. Same as Mostek 4116-4. 250 NS access. 410 NS cycle time. Our best price yet for this state of the art RAM. 32K and 64K RAM boards using this chip are readily available. These are new, fully guaranteed devices by a major mfg. **VERY LIMITED STOCK!**

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450 NS!

Now full speed! Prime new units from a major U.S. Mfg. 450 N.S. Access time. 1K x 8. Equiv. to 4-1702 A's in one package.

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- LED BRIGHTNESS CONTROL
- POWER FAILURE INDICATOR
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- DIRECT LED DRIVE (LOW RFI)
- COMES WITH FULL DATA

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We have a limited number of the 24 HR Real time version of this module in stock.

#MA1008D — $9.95

PERFECT FOR USE WITH A TIMEBASE.

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By MOSTEK, or ZILOG. The most detailed explanation ever on the working of the Z-80 CPU CHIPS. At least one full page on each of the 158 Z-80 instructions. A MUST reference manual for any user of the Z-80. 300 pages. Just off the press. **$12.95**

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A full .80 inch character. The biggest readout we have ever sold! Super efficient. Compare at up to $2.95 each from others!

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FND 850 Common Cathode **$1.49 ea (6 for $6.95)**

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RF POWER transistors

2NRF-1 2 GHz RF power transistor. Pd max (@ 25 degrees C) 3.5W, Pout min @ 2 GHz 1.0W, Pin 310 mW, efficiency @ 2 GHz 30%, round shape, similar to RCA 2N5470. **$4.95**

2NRF-2 2 GHz RF power transistor. Pd 8.7W, Pout 2.5W, Pin 300 mW, efficiency 33%, cross shape, similar to RCA TA8407. **$5.95**

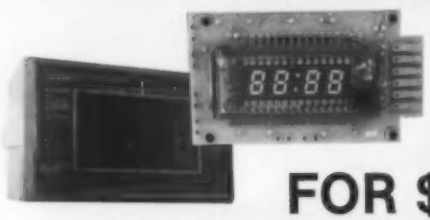
2NRF-4 2 GHz RF power transistor. Pd 29W, Pout 7.5W, Pin 1.5W, efficiency 33%, cross shape. Factory selected, prime 2N6269. **$7.95**

2NRF-3 2 GHz RF power transistor. Pd 21W, Pout 5.5W, Pin 1.25W, efficiency 33%, cross shape. Similar to RCA 2N6269. **$6.95**

WHAT'S BIPOLAR, REGULATED, SIMPLE, VIRTUALLY BLOW-OUT PROOF, DELIVERS ±250 mA MINIMUM, AND COSTS ONLY $15? A GODBOUT BIPOLAR POWER SUPPLY KIT!

These power supplies are great for fixed voltage applications. Available in ±5V, ±6V, ±8V, ±9V, ±12V, and ±15V models — specify project #13-XX, where the XX stands for the desired voltage. Compact, simple assembly.

MA1003 clock module, MA1003 matching case:



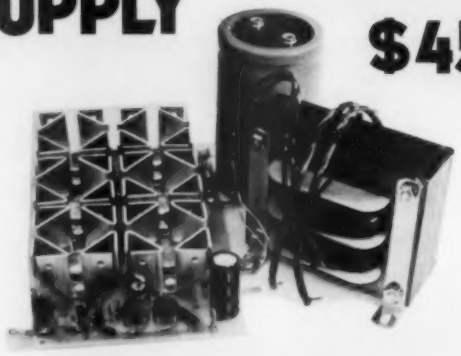
NOW GET BOTH FOR $19.95!

The MA1003 is a popular clock module that features blue-green fluorescent readouts (won't wash out in daylight), a highly accurate built-in timebase (excellent for mobile/portable operation and battery backup applications), and really easy assembly . . . add time setting switches, +12V DC, and you're ready to go. So simple, it makes a great one evening project; so inexpensive, you can afford to have accurate, electronic time-keeping not only in your home but in your car, truck, or van.

Our matching case has a simulated woodgrain front, mounting bracket and hardware, and a blue filter that really brings out the best in the MA1003 readouts. Best of all, it's compact . . . and even has pilot holes pre-drilled for 2 time-setting switches and an optional display switch. Comes complete with applications data.

It's about time someone came up with a simple, inexpensive, easy to assemble clock . . . here it is. If you wish, the clock module is available separately for **$16.50** each **(3/$46)**, and the case for **$5.95** each.

12V 8A POWER SUPPLY $45



This kit has sold consistently since we introduced it back in '73, and it's no wonder. Hams and CBers use it for powering mobile transceivers in the home, techs use it for a bench supply, computer owners use it to power bunches of floppy disks, and a major hi-fi chain even bought several of them for powering auto tape players in their stores. Handles 12A with 50% duty cycle, and features crowbar overvoltage protection, foldback current limiting, adjustable output 11-14V, custom wound heavy-duty transformer, RF suppresssion, and simplified assembly (all parts except transformer, filter caps, and diodes mount on circuit board). With complete assembly instructions. Does not include case.

WE ALSO HAVE A LONG LINE OF COMPUTER PRODUCTS THAT SUPPORTS THE S-100, APPLE, TRS-80, DIGITAL GROUP, AND SBC BUSSES. FOR MORE INFORMATION, SEE OUR ADS IN THE COMPUTER MAGAZINES, WRITE FOR OUR FLYER, OR VISIT YOUR LOCAL COMPUTER STORE.

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GODBOUT G4

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Transistor Checker

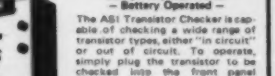
— Completely Assembled —
— Battery Operated —

The ABI Transistor Checker is capable of checking a wide range of transistor types, either "in circuit" or out of circuit. To operate, simply plug the transistor to be checked into the front panel socket, or connect it with the alligator clip test leads provided. The unit safely and automatically identifies low, medium and high-power PNP and NPN transistors. Size: 3½" x 6¼" x 2"

"C" cell battery not included.

Trans-Check **$29.95 ea.**

Custom Cables & Jumpers



DB 25 Series Cables

Part No.	Cable Length	Connectors	Price
DB25P-4-P	4 Ft.	2-DP25P	$15.95 ea.
DB25P-4-S	4 Ft.	1-DP25P/1-25S	$16.95 ea.
DB25S-4-S	4 ft.	2-DP25S	$17.95 ea.

Dip Jumpers

DJ14-1	1 ft.	1-14 Pin	$1.59 ea.
DJ16-1	1 ft.	1-16 Pin	1.79 ea.
DJ24-1	1 ft.	1-24 Pin	2.79 ea.
DJ14-1-14	1 ft.	2-14 Pin	2.79 ea.
DJ16-1-16	1 ft.	2-16 Pin	3.19 ea.
DJ24-1-24	1 ft.	2-24 Pin	4.95 ea.

For Custom Cables & Jumpers, See JAMECO 1979 Catalog for Pricing

CONNECTORS
25 Pin-D Subminiature

DB25P (as pictured)	PLUG (Meets RS232)	$2.95
DB25S	SOCKET (Meets RS232)	$3.50
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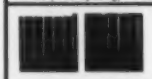
PRINTED CIRCUIT EDGE-CARD

.156 Spacing-Tin-Double Read-Out — Bifurcated Contacts — Fits .054 to .070 P.C. Cards

15/30	PINS (Solder Eyelet)	$1.95
18/36	PINS (Solder Eyelet)	$2.49
22/44	PINS (Solder Eyelet)	$2.96
50/100 (.100 Spacing)	PINS (Wire Wrap)	$6.95
50/100 (.125 Spacing)	PINS (Wire Wrap) RB81-1	$6.96

Solar Cells 2x2cm

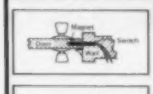


- 0.4 volts
- 100mA
- 41 MW

Can be added in series for higher voltage or parallel for higher current.

#SC 2x2 **$1.95 ea. or 3/$5.00**

Magnetically Activated Switch



The 9250-0002 is a single pole normally closed switch. When the magnet is engaged, the circuit is open. This switch is only suitable for use in non-magnetic doors and windows.

#9250-0002 **2/$1.00**

AC Wall Transformer

Ideal for use with clocks, power supplies or any other type of AC application.

Part No.	Input	Output	Price
AC 250	117V/60Hz	12 VAC 250mA	$3.95
AC 500	117V/60Hz	12 VAC 500mA	$4.95

REMOTE CONTROL TRANSMITTER & RECEIVER

$19.95

INSTRUMENT/CLOCK CASE

This case is an injection molded unit that is ideal for uses such as DVM, COUNTER, or CLOCK cases. It has dimensions of 4½" in length by 4" in width by 1-9/16" in height. It comes complete with a red bezel.

PART NO: IN-CC $3.49 each

MICROPROCESSOR COMPONENTS

6800/6802 SUPPORT DEVICES

6800A	CPU	$ 9.95
6810	0-Bit Input/Output	3.00
6214	Priority Interrupt Control	5.95
6216	Bi-Directional Bus Driver	3.49
6224	Clock Generator/Driver	3.95
6226	Bus Driver	3.49
6228	System Controller/Bus Driver	5.95
6238	System Controller	5.85
6251	Prog. Comm. I/O (USART)	7.95
6253	Prog. Interval Timer	14.95
6255	Prog. Periph. I/O (PPI)	9.85
6257	Prog. DMA Control	19.95
6259	Prog. Interrupt Control	19.95

6500/6800 SUPPORT DEVICES

MCS6500	MPU	$14.95
MCS6500CP	MPU with Clock and Ram	24.95
MCS6810API	128X8 Static Ram	5.95
MCS6821	Periph. Inter. Adapt (MC6820)	7.49
MCS6828	Priority Interrupt Controller	12.95
MCS6301L8	1024X8 Bit ROM (MC68A30-R)	14.95
MCS6850	Asynchronous Comm. Adapter	7.95
MCS6852	Synchronous Serial Data Adapt.	9.95
MCS6860	0-600 bps Digital MODEM	12.95
MCS6862	2400 bps Modulator	14.95
MCS6880A	Quad 3-State Bus. Trans. (MC8726)	2.15

MICROPROCESSOR CHIPS - MISCELLANEOUS

Z80(7MHz)	CPU	$19.95
Z80A(780-1)	CPU	24.95
CDP1802	CPU	19.95
2650	MPU	19.95
8035	2-Bit MPU w/clock, RAM, I/O lines	19.95
PR005	CPU	19.95
TMS9900JL	16-Bit MPU w/hardware, multiply & divide	49.95

SHIFT REGISTERS

MM5004N	Dual 25 Bit Dynamic	$.50
MM5005N	Dual 50 Bit Dynamic	.90
MM5044N	Dual 16 Bit Static	.50
MM5050N	Dual 100 Bit Static	.50
MM5018N	Dual 64 Bit Accumulator	.50
MM5016N	500/512 Bit Dynamic	.99
2504T	1024 Dynamic	3.95
2518	Hex 32 Bit Static	4.95
2522	Dual 132 Bit Static	2.95
2524	512 Static	.99
2525	1024 Dynamic	2.95
2527	Dual 256 Bit Static	2.95
2539	Dual 250 Static	4.00
2559	Dual 240 Bit Static	4.00
2532	Quad 80 Bit Static	2.95
2533	1024 Static	2.95
3341	Fifo	6.95
74LS670	4X4 Register File (TriState)	1.95

UART'S

A-Y-5-1013	30K BAUD	5.95

MICROPROCESSOR MANUALS

M-Z80	User Manual	$7.50
M-CDP1802	User Manual	7.50
M-2650	User Manual	5.00

ROM'S

2513(2140)	Character Generator(upper case)	$9.95
2513(3021)	Character Generator(lower case)	9.95
2516	Character Generator	10.95
MM6230N	2048-Bit Read Only Memory	1.95

RAM'S

1101	256X1	Static	$1.49
1103	1024X1	Dynamic	.99
2101(8101)	256X4	Static	3.95
2102	1024X1	Static	1.79
2102L02	1024X1	Static	1.65
2111(8111)	256X4	Static	3.95
2112	256X4	Static MOS	4.95
2114	1024X4	Static 450ns	8.95
2114L	1024X4	Static 450ns low power	10.95
2114-3	1024X4	Static 300ns	10.95
2114L-3	1024X4	Static 300ns low power	11.95
2161	256X4	Static	7.95
5280/2107	4096X1	Dynamic	4.95
7489	16X4	Static	1.75
74S200	256X1	Static TriState	4.95
80401	1024X1	Static	2.95
UPD414 (MK4027)	4K	Dynamic 16 pin	4.95
UPD416 (MM-4116)	16K	Dynamic 16 pin	14.95
TMS4044-45NL	4K	Static	14.95
TMS4046	1024X4	Static	14.95
2117	16,384X1	Dynamic 250ns (Novice marked)	9.95
MM5262	2Kx1	Dynamic	4/1.00

PROM'S

1702A	2048	FAMOS	$5.95
TMS2516	16K*	EPROM(Intel 2716)	49.95
(2716)	*Requires single +5V power supply		
TMS2532	4K33	EPROM	89.95
2708	8K	EPROM	16.95
2716 T.I.	16K**	EPROM	29.95
	**Requires 3 voltages, —5V, +5V, +12V		
5203	2048	FAMOS	14.95
6301-1(7611)	1024	Tristate Bipolar	3.49
6330-1(7602)	256	Open C Bipolar	2.95
82S23	32X8	Open Collector	3.95
82S115	4096	Bipolar	19.95
82S123	32X8	Tristate	3.95
74188	512	TTL Open Collector	9.95
74188	256	TTL Open Collector	3.95
74S287	1024	Static	2.95

CSC CONTINENTAL SPECIALTIES
PROTO BOARDS

Proto Board 203

A total ready-to-use power breadboard prototype device with a built-in regulated, short proof power supply. Just plug in and start building! 2 extra floating 5-way binding posts for external inputs. Self-contained with power switch indicator lamp and power fuse. 24-14 pin DIP capacity. An inactive two-tone quality case. All metal construction. 5¾"L x 6½"W x 2¾"H. 3½ lbs.

PB 203 **$75.00**

Proto Board 203A

All the features of the PB-203 plus additional power supply flexibility, provides 1% Regulated 5VDC supply from specifications as PB 203. Plus added opposite +15VDC and —15 VDC 0.5A supplies, each individually and independently adjustable output voltage. Ripple and noise of + and —15V supplies, 10mV at 0.25A.

PB 203A **$124.95**

Model Number	L x W x H (Inches)	Price
PB-8	6.0 x 4.5 x 1.4	$19.95
PB-100	6.0 x 4.5 x 1.4	$19.95
PB-101	6.0 x 4.5 x 1.4	$22.95

Model Number	L x W x H (Inches)	Price
PB-102	7.0 x 4.5 x 1.4	$26.95
PB-103	9.0 x 6.0 x 1.4	$44.95
PB-104	9.6 x 8.0 x 1.4	$54.95

B&K PRECISION 3½-Digit Portable DMM

- Overload Protected
- .3" high LED Display
- Battery or AC operation
- Auto Zeroing
- 1mv, 1kΩ, 0.1 ohm resolution
- Overrange reading
- 10 meg input impedance
- DC Accuracy 1% typical

Ranges: DC Voltage - 0-1000V; AC Voltage 0-1000V; Freq. Response 50-400 HZ; DC/AC Current 0-10mA; Resistance 0-10 meg ohm. Size 6.4" x 4.4" x 2"

Model 2800 $99.95

Comes with test leads, operating manual and spare fuse.

Accessories:

AC Adapter BC-28	$9.00
Rechargeable Batteries BP-28	20.00
Carrying Case LC-28	7.50

CSC 100 MHz 8-Digit Counter

- 20 Hz-100 MHz Range
- .6" LED Display
- Crystal-controlled timebase
- Fully Automatic
- Portable — completely self-contained
- Size — 1.75" x 7.38" x 5.63"
- Four power sources, i.e. batteries, 110 or 220V with charger 12V with auto lighter adapter and external 7.2-10V power supply

MAX-100 $134.95

ACCESSORIES FOR MAX 100:

Mobile Charger Eliminator use power from car battery	Model 100 — CLA $3.95
Charger/Eliminator use 110 V AC	Model 100 — CAI $9.95

New CSC Mini-Max 6 Digit 50MHz Frequency Counter

- Guaranteed frequency range of 100 Hz to 50 MHz
- Full 6 digit display with arrogiare window
- Fully automatic-range, polarity, slope, trigger, input level switching not required
- Lead-zero blanking — All zeros to the left of the first non-zero digit are blanked. Kilo Hertz and Mega Hertz decimal points automatically light up when the unit is turned on.
- Built in input overvoltage protection
- Use 9V Battery or 110/220V power
- Complete with mini antenna.
- Lightweight — Only 8oz.

MINI-MAX $89.95

Accessories For Mini-Max

Part No.	Description	Price
MM-A4	Antenna	$ 3.95
MM-CS	Carrying case	5.95
MM-PC	Input cable with clip leads	3.95
MM-AC2	110V adapter	9.95
MM-AC3	220V adapter	9.95

$10.00 Minimum Order — U.S. Funds Only
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J11

The Incredible "Pennywhistle 103"

$139.95 Kit Only

The Pennywhistle 103 is capable of recording data to and from audio tape without critical speed requirements for the recorder and it is able to communicate directly with another modem and terminal for telephone "hamming" and communications. In addition, it is free of critical adjustments and is built with non-precision, readily available parts.

Data Transmission Method	Frequency-Shift Keying, full-duplex (half-duplex selectable)
Maximum Data Rate	300 Baud
Data Format	Asynchronous Serial (return to mark level required between each character).
Receive Channel Frequencies	2025 Hz for space, 2225 Hz for mark.
Transmit Channel Frequencies	Switch selectable: Low (normal) = 1070 space, 1270 mark; High = 025 space, 2225 mark.
Receive Sensitivity	—46 dbm accoustically coupled.
Transmit Level	—15 dbm nominal. Adjustable from —6 dbm to —20 dbm.
Receive Frequency Tolerance	Frequency reference automatically adjusts to allow for operation between 1800 Hz and 2400 Hz.
Digital Data Interface	EIA RS-232C or 20 mA current loop (receiver is optoisolated and non-polar).
Power Requirements	120 VAC, single phase, 10 Watts.
Physical	All components mount on a single 5" by 9" printed circuit board. All components included.

Requires a VCM, Audio Oscillator, Frequency Counter and/or Oscilloscope to align.

TRS-80 16K Conversion Kit

Expand your 4K TRS-80 System to 16K. Kit comes complete with:

- 8 each UPD416 (16K Dynamic Rams)
- Documentation for conversion

TRS-16K $115.00

Special Offer - Order both your TRS-16K and the Sup'R' MOD II Interface kit together (retail value $144.95) **for only $139.95**

COMPUTER CASSETTES

- 6 EACH 15 MINUTE HIGH QUALITY C-15 CASSETTES
- PLASTIC CASE INCLUDED
- 12 CASSETTE CAPACITY
- ADDITIONAL CASSETTES AVAILABLE @C-15-$2.50 ea

CAS-6 $14.95

(Case and 6 Cassettes)

SUP 'R' MOD II
UHF Channel 33 TV Interface Unit Kit

Wide Band B/W or Color System

- Converts TV to Video Display for home computers, CCTV camera, Apple II, works with Cromeco Dazzler, SOL-20, IRS-80, Challenger, etc.
- MOD II is pretuned to Channel 33 (UHF).
- Includes coaxial cable and antenna transformer

MOD II $29.95 Kit

RS-232 CONTROL CENTER

Plug in your modem, computer prom programmer, terminal, printer, etc. and selectively control data flow.

- Same Contour as "Pennywhistle 103"
- Totally self-contained
- Includes 2 master ports and 3 slave ports.

PART NO. RS-232CC $89.95 kit only

CASSETTE CONTROLLER

Ideal for use with the TRS 80 and others.

"Plug/Jack interface to any computer system requiring remote control of cassette functions"

The CC100 controls cassette motor functions, monitors tape location with its internal speaker and requires no power. Eliminates the plugging and unplugging of cables during computer loading operation from cassette.

@CC-100 $29.50

63-Key Unencoded Keyboard

This is a 63-key, terminal keyboard newly manufactured by a large computer manufacturer. It is unencoded with SPST keys, unattached to any kind of PC board. A very solid molded plastic 13 x 4" base suits most application. IN STOCK **$29.95/each**

Hexadecimal Unencoded Keypad

19-key pad includes 1-10 keys, ABCDF and 2 optional keys and a shift key. **$10.95/each**

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SALE

*Buy any item on this page and choose 2nd item for only one penny!

* of the same cat. no.

A PENNY MORE GETS YOU TWO

☐	0- SKINNY TRIM POTS, PRECISION, asst. styles, values 50% yield (→3389)	1.29	12 for 1.30
☐	60pc. PRECUT, PRETINNED WIRE, various lengths and colors (→1971)	1.29	120 for 1.30
☐	60- MINI RESISTORS, ¼ watt, asst., vorl, 1/4W, color coded (→2235)	1.29	120 for 1.30
☐	8 TRANSISTOR RADIO EARPHONES, 8 ohms impad (→2946)	1.29	16 for 1.30
☐	10- 5K POTS, audio taper, plastic snap-in mounting (→5124)	1.29	20 for 1.30
☐	10- 1&2 MEG DUAL POTS, audio taper, "snap-in" mnt (→5125)	1.29	20 for 1.30
☐	50- 1 AMP ZENERS, wide asst. of values, untested (→1964)	1.29	100 for 1.30
☐	12 SCR'S & TRIACS, 10 AMP, asst. values, untested (→3087)	1.29	24 for 1.30
☐	3 QUADRACS, 10 AMP, 100% prime, 50-100-200 V, TO-220 (→5048)	1.29	6 for 1.30
☐	20- Mini RECTIFIERS, 1½ AMPS, 25V, epoxy, axial (→5376)	1.29	40 for 1.30
☐	10 1N4007 1000V MINI RECTIFIER, epoxy, axial leads (→2353)	1.29	20 for 1.30
☐	75 MOLEX CONNECTOR Type M1938-4, makes 14 to 40 pin sockets (→1609)	1.29	150 for 1.30
☐	50 IF TRANSFORMERS, asst sizes (→3549)	1.29	100 for 1.30
☐	10 T.V. CHASTER CORD JACKS, (→5519)	1.29	20 for 1.30
☐	10- 1 AMP 200V MINI RECTIFIER, IN4003, epoxy, axial (→2379)	1.29	20 for 1.30
☐	4- 1.5V SILVER OXIDE WATCH BATTERIES, (→5063)	1.29	8 for 1.30
☐	3- LCD WATCH READOUTS, 3½" digits, 7 seg, dim 1½ x 1" (→5060)	1.29	6 for 1.30
☐	20- IC DICE CHIP, complete circuitry, asst. sizes (→5063)	1.29	40 for 1.30
☐	2- 100KHz MARKER CRYSTALS, specify 104.067, 104.092, or 114.90 MHz (→3806)	1.29	4 for 1.30
☐	12- 1.5V LAMP AND SOCKET SET, 200ma, T2 style (→3956)	1.29	24 for 1.30
☐	10- RCA PHONO JACKS, chassis mount, teflon base (→5119)	1.29	20 for 1.30
☐	10- COAXIAL PIN HEAD LEDS, RED (→5617)	1.29	20 for 1.30
☐	4- 5-DIGIT 7-SEGMENT READOUTS, in flat pak case (→5616)	1.29	8 for 1.30
☐	4- ¼" BLOCK TRIM POTS, 5K (→2536)	1.29	8 for 1.30
☐	1- "FOTO FET" N CHANNEL, Crystalonics, 2 Sealed Effect Transistors, (→1100)	1.29	2 for 1.30
☐	1- VOLTAGE REGULATOR, TO202 case, 12V 600MA (→1900)	1.29	2 for 1.30
☐	1- 3 DIGITS ON A DIP, LED, red, DL 33 (→1887)	1.29	2 for 1.30
☐	1- MM5262 2K DYNAMIC RAM, specify type (→3459)	1.29	6 for 1.30
☐	10- 2N711 HIGH SPEED SWITCHING TRANSISTORS, TO18, npn (→3374)	1.29	20 for 1.30
☐	2- 15W HI POWER TRANSISTORS, 220V, npn, TO66 (→2797)	1.29	4 for 1.30
☐	3- 24 PIN IC SOCKETS (→2160)	1.29	6 for 1.30
☐	1- MM5311 DIGITAL CLOCK CHIP, 100% (→1525)	1.29	2 for 1.30
☐	2- MM5726 4 FUNCTION CALCULATOR CHIP, 100% (→3036)	1.29	4 for 1.30
☐	1- MM5202 ERASABLE PROM, 100% (→3459)	1.29	2 for 1.30
☐	3- 10 AMP 25V BRIDGE RECT, comb style (→2447)	1.29	6 for 1.30
☐	10- 2N3565 RF TRANSISTORS, TO106, 2N5133 (→3372)	1.29	20 for 1.30
☐	6 LINEAR SWITCHING TRANSISTORS, 2N2905, pnp, TO5 (→3375)	1.29	12 for 1.30
☐	50- 2 AMP CYLINDRICAL RECT, up to 1R, w test (→4006)	1.29	100 for 1.30
☐	6- OPEN FACE READOUTS, LED, red, some segs missing mostly dusk (→3962)	1.29	12 for 1.30
☐	10- 2N2222 or equiv., TO-18 metal case (→1992)	1.29	20 for 1.30
☐	10- DATA ENTRY SWITCHES, SPST, ½ amp, norm open 125V (→5333)	1.29	20 for 1.30
☐	8 TRANSISTOR RADIO EARPHONES, 8 ohms impad (→2946)	1.29	16 for 1.30
☐	3½ FLUORESCENT OVERFLOW READOUT TUBES, w/leads (→3389)	1.29	6 for 1.30
☐	10- 2N3704 TO92 TRANSISTORS (→3490)	1.29	20 for 1.30
☐	1- 2N5001 80V TRANSISTORS STUD (→2800)	1.29	2 for 1.30
☐	3 MICROPROCESSOR/SUPPORT CHIPS, asst. MM5780-90 series, 24-28 pin (→5639A)	1.29	6 for 1.30
☐	1- CLOCK/CALCULATOR CHIPS, asst. MM5378, 75, 5737 etc. (→5638A)	1.29	2 for 1.30
☐	25 DTL FAIRCHILD IC's, gates and flip flops, Dip, 100% (→3709)	1.29	50 for 1.30
☐	1- 24 VOLT 50 MIL. TRANSFORMER, 115 V input, open frame, 1" x 1" x 3/4" (→5631)	1.29	2 for 1.30
☐	10- 2N3704 TRANSISTORS, silicon, TO-92 case, hfe 300, 100% (→5625)	1.29	20 for 1.30
☐	10- 2N3705 TRANSISTORS, silicon, TO-92 case, hfe 150, 100% (→5626)	1.29	20 for 1.30
☐	10 D33021 TRANSISTORS, low power, silicon, hfe-60, TO-92 (→5627)	1.29	20 for 1.30
☐	1- ALLEN BRADLEY POT, 10K, 2-1 4 watts, type J, 2" x ¼" shaft (→1748)	1.29	2 for 1.30
☐	50 ASST. RED LED'S, 100% or better, various styles (→5624)	1.29	100 for 1.30
☐	10- G.E. POWER TAB TRANSISTORS, D40H1, 2, some NS, TO 220 (→5629)	1.29	20 for 1.30
☐	2- ¼" BLOCK TRIM POTS, 200K (→2535)	1.29	4 for 1.30
☐	1- 12VDC 5MIL REED RELAY, spst, N.O. 2200 ohms, 7/8" x 9/16" x 5/16" (→5618)	1.29	2 for 1.30
☐	50 TEMP. COEFFICIENT VOLTAGE REFERENCE DIODES, asst. vals, +96% (→5647)	1.29	100 for 1.30
☐	8 DLM 380 IC's, 2 watts, dip, 50%+ yield, U-test (→1975)	1.29	20 for 1.30
☐	50 RED BLOCK DISC CAPS, assorted values, 50% material (→1693)	1.29	100 for 1.30
☐	50 SHOCKLEY DIODES, most popular switching diode, hobby & untested (→1072A)	1.29	100 for 1.30
☐	10- COUPLER, 1500V isolation, hobby material, U-test (→5629A)	1.29	12 for 1.30
☐	4 CHERRY MICRO SWITCH, 125 VAC, 15A, N.C. type E-13, screw terminals (→5525)	1.29	8 for 1.30
☐	5 SPST PUSHBUTTON MOMENTARIES, rt. angle, pc mt, on-on (→5633)	1.29	10 for 1.30
☐	25 TTL's, w/7400's, 7402's, dips (→2439)	1.29	50 for 1.30

☐	30 RADIO AND TV KNOBS, asst styles, sizes (→B217)	1.29	60 for 1.30
☐	60 TUBULAR CAPACITORS, asst volts and sizes (→B219)	1.29	120 for 1.30
☐	60 LOW NOISE RESISTORS, ¼ watt, 1%, asst. (→B220)	1.29	120 for 1.30
☐	50 POWER RESISTORS, 3-5-7 w. axial, pop sizes (→B228)	1.29	100 for 1.30
☐	925 SURPRISE, all kinds of parts in a pak (→B294)	1.29	2 for 1.30
☐	12 PANEL SWITCHES, rotary, slide, toggle, etc (→B298)	1.29	24 for 1.30
☐	60 COILS AND CHOKES, rf, parasitic, if, etc (→B297)	1.29	120 for 1.30
☐	60 TERMINAL STRIPS, up to 4 solder lugs (→B334)	1.29	120 for 1.30
☐	60 PRECISION RESISTORS, ½W, 1%, axial (→B363)	1.29	120 for 1.30
☐	80 MICA CAPACITORS, asst values (→B373)	1.29	160 for 1.30
☐	10 SETS RCA PLUGS AND JACKS, phono (→B402)	1.29	20 for 1.30
☐	60 DISC CAPACITORS, asst values long leads (→B437)	1.29	120 for 1.30
☐	20 TRANSISTOR ELECTRO'S, asst up and an (→B453)	1.29	40 for 1.30
☐	75 HALF WATTERS, resistors, color coded, asst (→B454)	1.29	150 for 1.30
☐	35 SILVER MICAS, rad backs, axial, asst. (→B455)	1.29	70 for 1.30
☐	6 50 AMP RECT, asst volts up to 25, stud (→L717)	1.29	12 for 1.30
☐	100 GERMANIUM DIODES, axial leads, a test (→L642)	1.29	200 for 1.30
☐	50 SIDACTORS, Regulator, sensing and computor. Axial, excellent yield (→3140)	1.29	200 for 1.30
☐	100 PRINTED CIRCUIT ½ WATT RESISTORS, asst (→U1060)	1.29	200 for 1.30
☐	12 TRANSISTOR SOCKETS, asst npn and pnp types (→U651)	1.29	24 for 1.30
☐	50- 3 AMP SILICON RECTIFIERS, axial, asst V (→U863)	1.29	100 for 1.30
☐	50 POLYSTYRENE CAPS, plastic coated, prec. (→U1052)	1.29	100 for 1.30
☐	10 MT. 2 bolts, for 110vac projects, hobby, etc (→U1222)	1.29	20 for 1.30
☐	10 PROXIMITY REED SWITCHES, (→U1256)	1.29	20 for 1.30
☐	6 2N3915 UHF TO-18 TRANSISTORS (→U1427)	1.29	12 for 1.30
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☐	5 MICRO SWITCHES, push, asst types (→U3015)	1.29	12 for 1.30
☐	50 ONE AMP ZENER DIODES, asst, axial, a test (→U1904)	1.29	100 for 1.30
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☐	6 ITS A SNAP, 9 VDC BAT-clip, red n black lead (→U3852)	1.29	12 for 1.30
☐	8 1400 VOLT "RED BALL" RECTIFIERS, axial 1 AMP (→U2890)	1.29	16 for 1.30
☐	20 1N4148 SWITCHING DIODES, 4 nsec, axial (→U3600)	1.29	40 for 1.30
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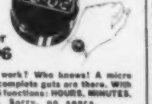

P2

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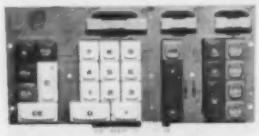

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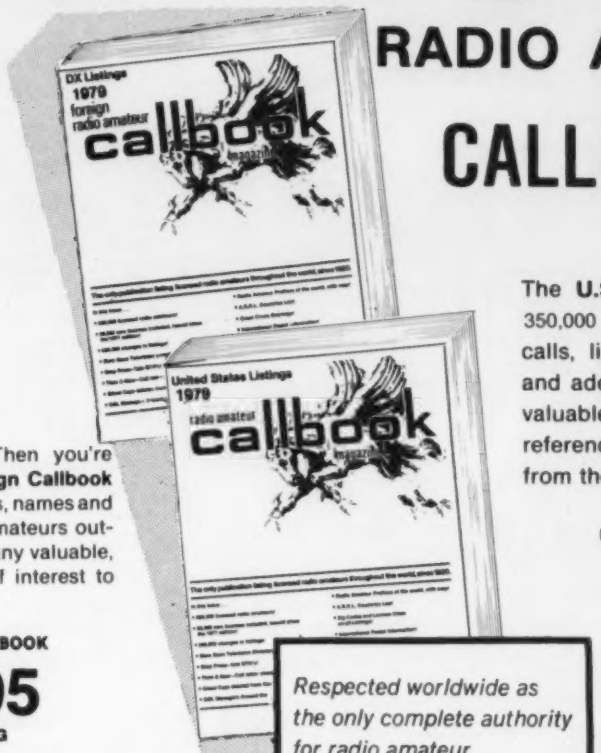

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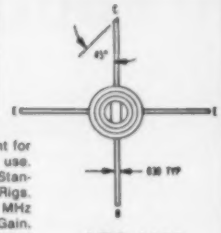

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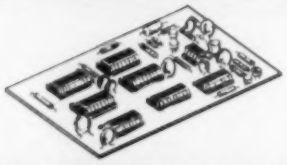

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1N4148	75v	10mA	.05
1N4733	5.1v	1 W Zener	.25
1N753A	6.2v	500 mW Zener	.25
1N758A	10v	"	.25
1N759A	12v	"	.25
1N5243	13v	"	.25
1N5244B	14v	"	.25
1N5245B	15v	"	.25

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16-pin	pcb	.20	ww	.40
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2N2222A		.19
2N2907A	PNP	.19
2N3906	PNP (Plastic Unmarked)	.10
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9309	.35	9601	.20
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LM308	.65	LM340T12	.95	LM725	2.50
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LM318	1.75	LM340K15	1.25	LM1458	.65
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7402	.15	7485	.55	75108A	.35	74LS05	.35
7403	.15	7486	.25	75491	.50	74LS08	.35
7404	.10	7489	1.05	75492	.50	74LS09	.35
7405	.25	7490	.45	74H00	.15	74LS10	.35
7406	.25	7491	.70	74H01	.20	74LS11	.35
7407	.55	7492	.45	74H04	.20	74LS20	.30
7408	.15	7493	.35	74H05	.20	74LS21	.35
7409	.15	7494	.75	74H08	.35	74LS22	.35
7410	.15	7495	.60	74H10	.35	74LS32	.35
7411	.25	7496	.80	74H11	.25	74LS37	.35
7412	.25	74100	1.15	74H15	.45	74LS38	.45
7413	.25	74107	.25	74H20	.25	74LS40	.40
7414	.75	74121	.35	74H21	.25	74LS42	.75
7416	.25	74122	.55	74H22	.40	74LS51	.45
7417	.40	74123	.35	74H30	.20	74LS74	.45
7420	.15	74125	.45	74H40	.25	74LS76	.50
7426	.25	74126	.35	74H50	.25	74LS86	.45
7427	.25	74132	.75	74H51	.25	74LS90	.65
7430	.15	74141	.90	74H52	.15	74LS93	.65
7432	.20	74150	.85	74H53	.25	74LS107	.50
7437	.20	74151	.65	74H55	.20	74LS123	1.20
7438	.20	74153	.75	74H72	.35	74LS151	.85
7440	.20	74154	.95	74H74	.35	74LS153	.85
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7444	.45	74163	.85	74L00	.25	74LS193	1.05
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7453	.20	74181	2.25	74L47	1.95	74S03	.25
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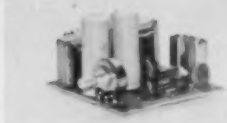

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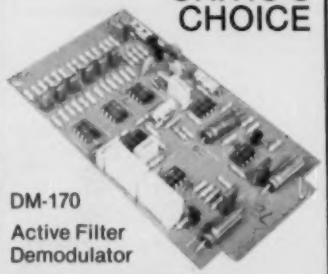

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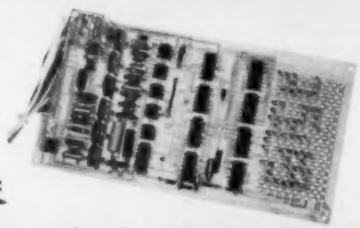

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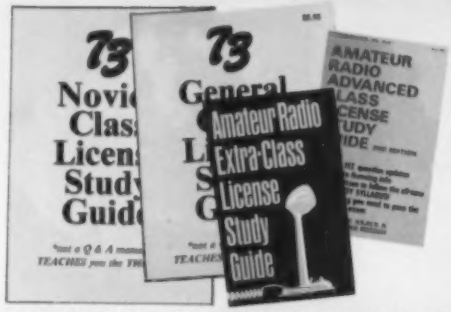

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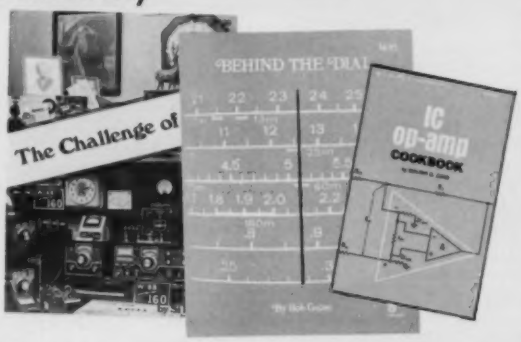

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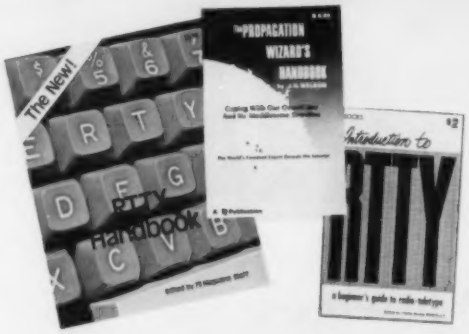

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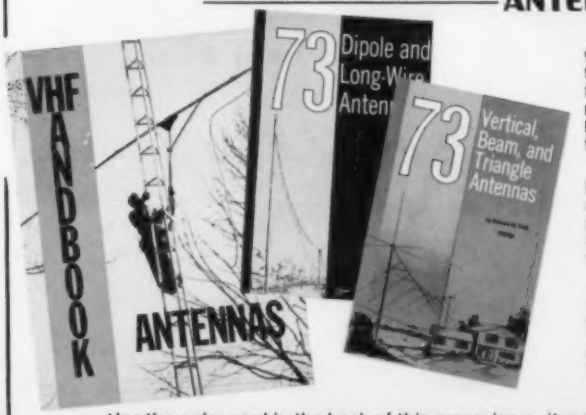

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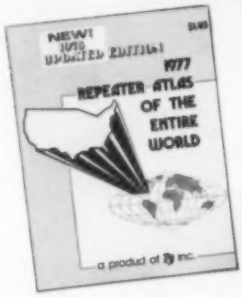

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ALASKA	14	14	14	7	7	7	7	7	7A	14	14	14
ARGENTINA	21	14A	14	14	7	7	14	21	21	21A	21A	21A
AUSTRALIA	21A	21	14	7B	7B	7B	7B	14	14	14B	14	21A
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INDIA	14	7B	7B	7B	7B	7B	14	14	21	21	14	14
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PUERTO RICO	14	14	7	7	7	7	14	14	14	21	21	21
SOUTH AFRICA	21	14	7	7	7	14	21	21A	21A	21A	21	21
U. S. S. R.	7	7	7	7	7	7A	14	21	21	14	14	7B
WEST COAST	21	14A	14	7	7	7	7B	14	21	21	21	21A

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HAWAII	21A	21	14	14	7	7	7	7A	14	21	21	21A
INDIA	14A	14	14	7B	7B	7B	7B	14	14	14	14	14
JAPAN	21	21	14	14	7B	7B	7	7	14B	14	14	21
MEXICO	21	14	7	7	7	7	7	14	14	21	21	21
PHILIPPINES	21	21	14	7B	7B	7B	7B	7B	14	14	14B	14
PUERTO RICO	21	21	14	7	7	7	14	21	21	21	21A	21A
SOUTH AFRICA	21	14	7	7B	7B	7B	14	14A	21	21A	21A	21
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EAST COAST	21	14A	14	7	7	7	7B	14	21	21	21	21A

A = Next higher frequency may also be useful
B = Difficult circuit this period
F = Fair
G = Good
P = Poor
SF = Chance of solar flares

april

sun	mon	tue	wed	thu	fri	sat
1 G	2 G	3 G	4 G/SF	5 G/SF	6 P/SF	7 P/SF
8 P/SF	9 F	10 F	11 G	12 G	13 G	14 G
15 G	16 G	17 G	18 G	19 G	20 G	21 G
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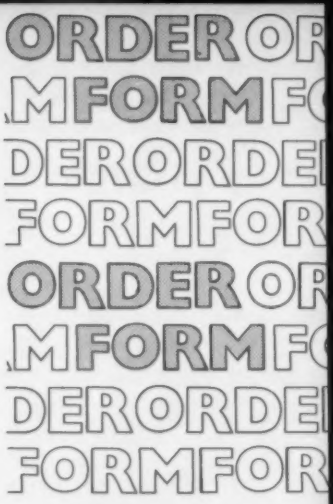

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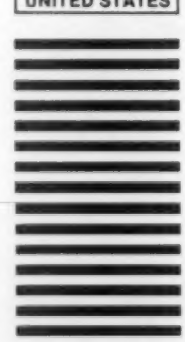

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YO-901
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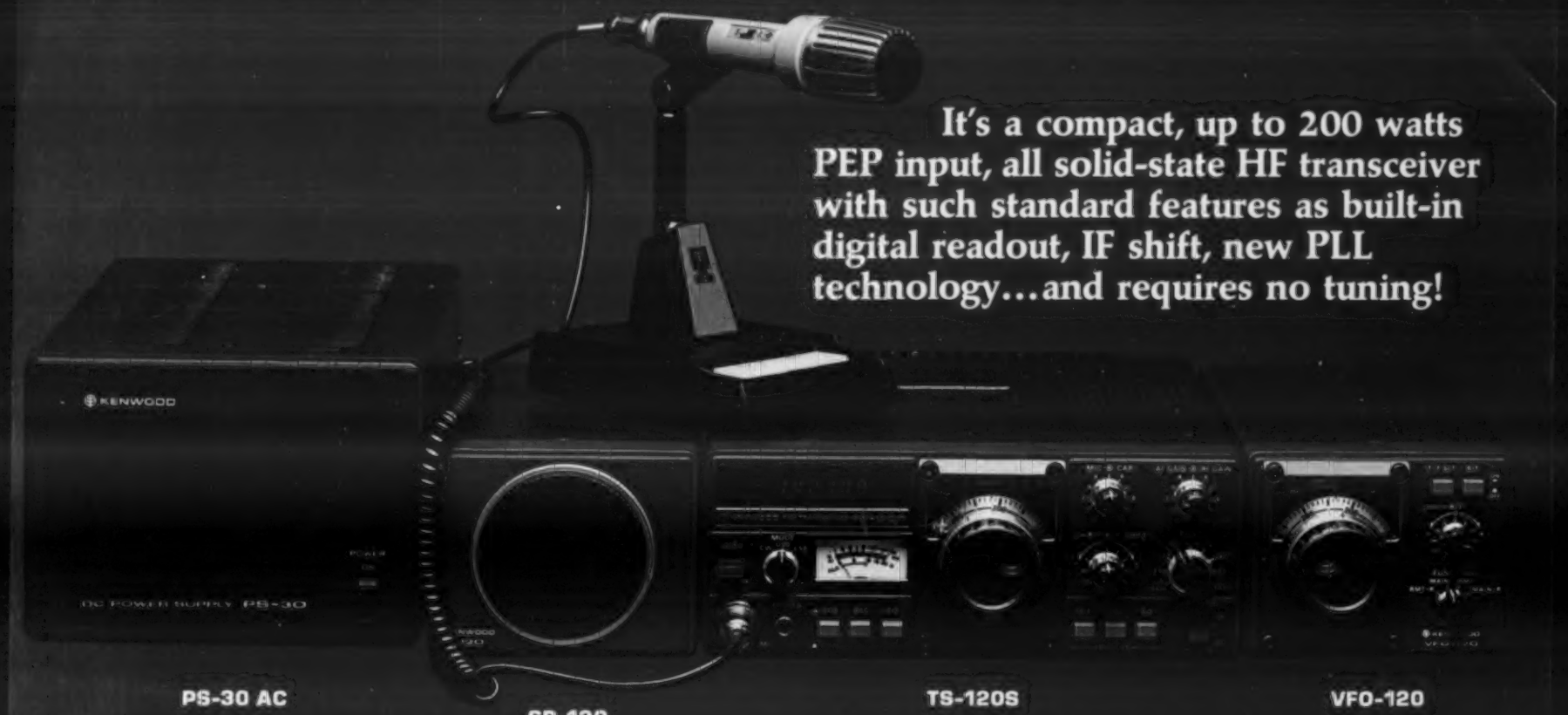
TS-120S... *A big little rig.*



It's a compact, up to 200 watts PEP input, all solid-state HF transceiver with such standard features as built-in digital readout, IF shift, new PLL technology...and requires no tuning!

PS-30 AC **SP-120** **TS-120S** **VFO-120**

Exciting and perfect for car or ham shack use! But, there's more to say about the TS-120S! This unique all solid-state HF, SSB/CW transceiver produces a hefty signal and also offers a lot of other features in a very attractive, compact package. See this new model at your Authorized Kenwood Dealer!

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